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BAY OF BENGAL PILOT

COMPRISING THE
SOUTHERN AND EASTERN COASTS OF CEYLON,
THE EASTERN COAST OF INDIA, THE COAST
OF EAST PAKISTAN, THE COAST
OF BURMA, AND THE WESTERN COAST OF
THAILAND FROM PAKCHAN RIVER TO KQ
PHUKET; ALSO THE ANDAMAN AND NICOBAR
ISLANDS

EIGHTH EDITION
1953

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3 TO MARINERS
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Movements in Ports.

SHIPOWNERS
-AGENTS FOR
YDROGRAPHIC

TO BRITISH

BRITISH MER-
VESSELS.

TO MERCHANT

RCISE AREAS.
SIGNALS, 1931.

TO SHIPS AP-

PROACHING SQUADRONS OR AIRCRAFT
CARRIERS.

No. 8 WARNING SIGNALS TO DENOTE THE
PRESENCE OF SUBMARINES.

No. 9 NAVIGATIONAL AND GALE WARNINGS,
ETC., BROADCAST BY RADIO IN GREAT
BRITAIN AND IRELAND.

No. 10 MINESWEEPING OPERATIONS.

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STATIONS.

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WARNINGS.

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OF NOTICES TO MARINERS.

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Adoption of New Style Compass Rose on Admiralty Charts.

No. 16 ADMIRALTY TIDE TABLES.

Addenda and Corrigenda.

No. 17 REPORTS OF SHOALS OBTAINED BY ECHO
SOUNDING.

No. 18 AREAS DANGEROUS DUE TO MINES :
SWEEPED ROUTES.

No. 19 THE INTERNATIONAL HYDROGRAPHIC
BUREAU.

No. 20 LAWS AND REGULATIONS APPERTAINING
TO NAVIGATION.

*Copies of these Notices can be obtained gratis by Masters of ships from Mercantile
Marine Offices in the United Kingdom. Copies may also be inspected at Dominion,
Indian and Colonial Government Shipping Offices and at British Consulates.*

**NOTATIONS OF SUPPLEMENTS AND ANNUAL
SUMMARIES OF NOTICES TO MARINERS
RELATING TO THIS BOOK.**

To be filled in by Navigating Officer.

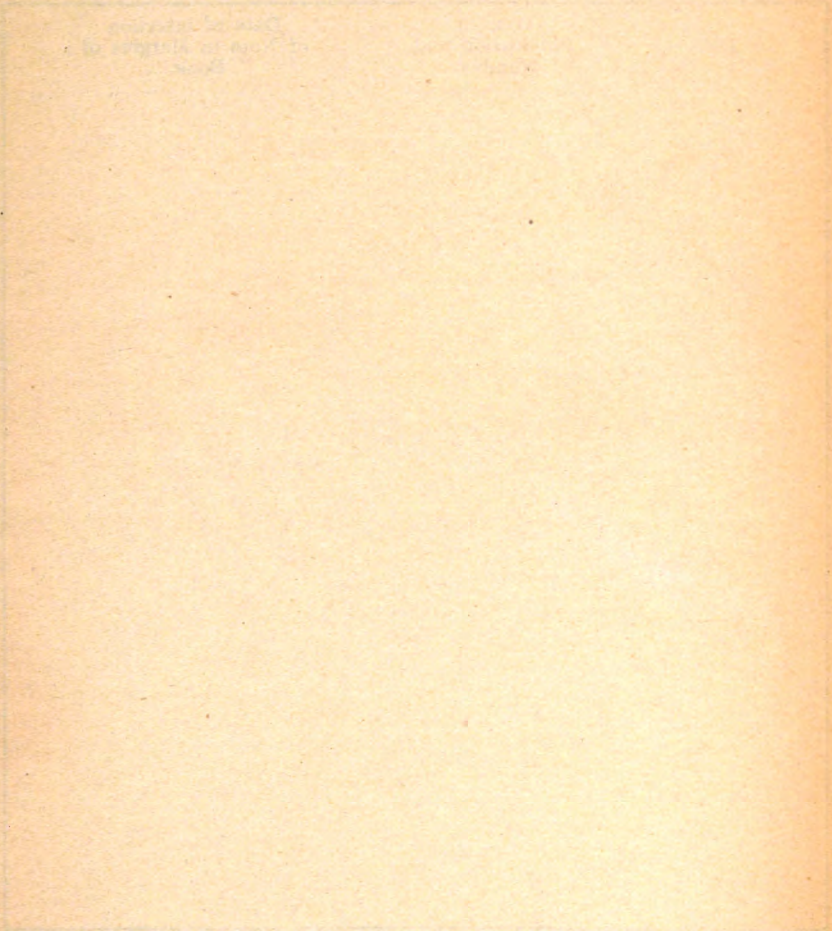
(In Chart Depôts the first two columns are alone to be filled up.)

Title.	Date of Publication and Number.	Date of insertion of Note in Margins of Book.

NOTICES OF SUPPLEMENTS AND ADDITIONS
TO THE HISTORY OF THE
CITY OF BOSTON

By J. W. L. GARDNER, Esq.

Published by the City of Boston, 1854.



NOTICE

This volume should not be used without reference to the latest Supplement and Summary of Notices to Mariners affecting it which may have been published.

A Supplement to this volume will generally be published annually with the latter is again issued for revision.

After the publication of Supplement No. 1 each succeeding Supplement carries the former.

Between the time of the volume being taken up for revision and the publication of the new volume no Supplement will be issued, but early in each year a Summary of the Admiralty Notices to Mariners affecting the volume which have been published during the preceding year will be issued as a separate publication.

The publication of all Supplements and Summaries of Notices to Mariners is announced in Admiralty Notices to Mariners.

The latest Supplement and any Annual Summary of Notices to Mariners that has been published affecting the volume will be available continuously for reference to this volume from the Admiralty Library. Admiralty charts and other Hydrographic publications on application either to the Admiralty or to the Hydrographic Office may be loaned for a limited period. For a list of these and other publications see Admiralty Notices to Mariners No. 2.

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The latest Supplement and any Annual Summary of Notices to Mariners that has been published affecting this volume will be obtainable gratuitously by purchasers of this volume from the Agents for the sale of Admiralty charts and other Hydrographic publications, on application either personally or by letter; in the latter case the cost of postage must be enclosed. For a list of these Agents see Admiralty Notice to Mariners No. 2, published annually.

Gt. Brit Hydrographic Office.
BAY OF BENGAL
PILOT

COMPRISING THE
SOUTHERN AND EASTERN COASTS OF CEYLON,
THE EASTERN COAST OF INDIA, THE COAST
OF EAST PAKISTAN, THE COAST OF BURMA,
AND THE WESTERN COAST OF THAILAND FROM
PAKCHAN RIVER TO KQ PHUKET; ALSO THE
ANDAMAN AND NICOBAR ISLANDS

EIGHTH EDITION, 1953

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LONDON
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To be obtained from the
Agents for the Sale of Admiralty Charts, etc.

1953

Price Seventeen Shillings and Sixpence Net

To face page ii.]

656
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CAUTION.

IN THIS WORK THE BEARINGS ARE REFERRED TO THE TRUE COMPASS, AND WHEN GIVEN IN DEGREES ARE RECKONED CLOCKWISE, FROM 000° (NORTH) TO 359°.

THE BEARINGS OF LIGHTS ARE GIVEN FROM SEAWARD.

THE LATITUDES AND LONGITUDES GIVEN IN THE TEXT ARE APPROXIMATE.

THE DISTANCES ARE EXPRESSED IN SEA-MILES OF 60 TO A DEGREE OF LATITUDE.

A CABLE'S LENGTH IS ASSUMED TO BE EQUAL TO THE TENTH PART OF A SEA-MILE. IT IS OFTEN ACCEPTED AS BEING ONE-TENTH OF A NAUTICAL MILE.

THE DEPTHS ARE GIVEN BELOW CHART DATUM LEVEL WHERE NOT OTHERWISE STATED.

HEIGHTS ON THE LAND ARE GIVEN ABOVE MEAN LEVEL OF HIGH WATER SPRING TIDES.

FIGURES IN BRACKETS GIVEN AFTER THOSE DENOTING FEET, FATHOMS AND YARDS ARE THEIR EQUIVALENTS IN METRES.

TIME IS EXPRESSED IN THE FOUR-FIGURE NOTATION COMMENCING AT MIDNIGHT.

THE TERM "POWER VESSEL" USED HEREIN INCLUDES ANY VESSEL PROPELLED BY MACHINERY.

A NAME IN BRACKETS, IMMEDIATELY FOLLOWING ANOTHER NAME, IS THE OBSOLETE NAME WHICH IS STILL SHOWN ON THE ADMIRALTY CHARTS. AS A GENERAL RULE, THE BRACKETED NAME IS ONLY INSERTED IN THE DESCRIPTION OF THE PLACE OR OBJECT PREVIOUSLY BEARING THAT NAME.

WHEN SHADING IS USED TO INDICATE COLOURS OF FLAGS, TIDAL LIGHT SIGNALS, OR BEACONS, IT IS AS FOLLOWS:



Yellow.



Red.



Blue.



Green.



Black.

ADVERTISEMENT TO EIGHTH EDITION

The Bay of Bengal Pilot contains a description of the southern and eastern coasts of Ceylon, the eastern coast of India, the coast of East Pakistan and the coasts of Burma and Thailand, commencing at Colombo, on the west, and ending at Kō Phuket, on the east, also the Andaman and Nicobar islands.

This, the eighth edition, has been prepared by Captain J. N. Tait, C.B.E., D.S.C., R.N., and contains the latest information received in the Hydrographic Department.

The meteorological and ocean currents information has been revised by the Meteorological Office of the Air Ministry. Temperature is expressed in degrees Fahrenheit, rainfall in inches, and speed in knots and distance in sea miles unless expressly stated otherwise. Information received from meteorological services which do not use these units has been converted into the units mentioned above by the Meteorological Office.

Mariners and others are invited in the interests of navigation to forward to the Hydrographer of the Navy, Admiralty, Oxgate Lane, Cricklewood, London, N.W.2, any information that may come under their notice, which would be useful for the correction of the charts and other hydrographic publications issued by the British Admiralty; *early* advice as to newly-discovered dangers, the establishment of, or changes in, any aids to navigation, is specially requested.

Copies of a form (H. 102) on which to render information can be obtained gratis from the Hydrographer of the Navy, Hydrographic Supplies Establishment, Creechbarrow House, Taunton, Somerset, or from any of the Admiralty Chart Agents in Great Britain and abroad, a list of whom is published, annually, in Admiralty Notice to Mariners No. 2.

By the publication of this volume, the seventh edition of the Bay of Bengal Pilot, 1940, and Supplement No. 7, 1952, are cancelled, and all information affecting that work contained in Notices to Mariners up to and including No. 2250 of 1953, has been embodied in this volume; for Temporary and Preliminary Notices to Mariners affecting this edition, the list of Temporary and Preliminary Notices to Mariners in force, published monthly in the weekly edition of the Admiralty Notices to Mariners, should be consulted.

A. DAY,
Vice-Admiral,
Hydrographer of the Navy.

Hydrographic Department,
Admiralty, London,
26th September, 1953.

BIBLIOGRAPHY

The following books, etc., have been used in preparing this edition :—

The Statesman's Year Book, 1953.

The Indian and Pakistan Year Book, 1951.

Kaybee's Indian Shipping Annual, 1951.

Ports of the World, 7th Edition, 1953.

Feux et Signaux de Brume, Série L. 1950.

CONTENTS

INTRODUCTORY

	PAGE
Caution	
Advertisement	iii
Bibliography	iv
List of contents	v
List of views	vii
Glossary of geographical terms and words	viii
System of Orthography	ix
Information relating to Admiralty Charts and Publications, General Navigation and General Meteorology	xiii
Index chart	<i>facing 1</i>

CHAPTER I

	PAGE
General remarks—Ceylon—India—East Pakistan—Burma —Thailand—Andaman and Nicobar islands—Currents —Tides—The Bore—Signals—Air lights—Buoyage system—Life-saving—Standard and Summer times— Communications—Fuel—Repairs—Submarine cables— Regulations—British Consular officers—Mud volcanoes —Climate and weather—Climatic tables	1-90

CHAPTER II

Western, southern and eastern coasts of Ceylon, from Colombo to Point Pedro	91-160
--	--------

CHAPTER III

Palk strait and bay	161-175
-------------------------------	---------

CHAPTER IV

Point Calimere to Godāvāri point	176-201
--	---------

CHAPTER V

Cocanāda to Balisahi point	202-228
--------------------------------------	---------

CHAPTER VI

Balisahi point to Elephant point, including the Hooghly river and the Sundarbans	229-263
---	---------

CHAPTER VII

Coast of Burma—Elephant point to Pagoda point	264-299
---	---------

CHAPTER VIII

Preparis island and channels, and the Coco, Andaman and Nicobar islands	300-364
--	---------

CHAPTER IX

Pagoda point to Tavoy point, including the Irrawaddy river and the Gulf of Martaban	365-418
--	---------

CHAPTER X

Coasts of Burma and Thailand—Tavoy point to Kō Phuket, including Mergui archipelago	419-486
--	---------

APPENDICES

I.—List of Ports available for under-water repairs	487-489
II. List of Principal Ports, showing particulars of depths, etc.	490-491
III.—Suitable spots for magnetic observations	492
Index	493-527

LIST OF VIEWS

	<i>On or facing page</i>
View, in three parts, of coast between Kolonna point and Tangalla	126
View, in two parts, of coast between Patirajja and Palatupana points	127
Views, in three parts, of coast between Palatupana and Butawa points	127
Two views, each in two parts, of leading marks for the channel inside Great and Little Basses reefs	130
View, in two parts, of coast between Pillinawa and Illukatiya points	131
View, in two parts, of coast between Illukatiya and Chen points	131
Friar's Hood from east-north-eastward	136
Mullaittivu light-structure	158
Point Calimere lighthouse	164
Cuddalore lighthouse	181
Mahabalipur lighthouse	185
Pulicat lighthouse	191
Armagon old lighthouse	192
Clearing mark for Santapilli rocks	212
Oyster island from eastward	267
Batti Malv island from north-north-eastward	350
Southern end of Great Nicobar island	362
China Bakir light-vessel	372
Eastern Grove light-structure	374
Spit light-and-bell float, Rangoon	375
Entrance to Ye river from north-westward	416
Leading mark for the western channel, Tavoy river	417
Leading mark for the northern approach channel to Pakchan river	480
Similan islands from east-north-eastward	481
Islands southward of KQ Phuket from westward	481

GLOSSARY

OF FOREIGN WORDS FOUND ON THE CHARTS AND IN THE SAILING DIRECTIONS

English.	Sinhalese.	Tamil.	Hindustani.	Burmese.	Malay.	Thai (Siamese).
Bay	Bókka	Kuda	Kol	Aw	—	Ao
Coast	Werala	Karai	Kinara Nadi, nulla	—	—	—
Creek	—	—	—	Chaug	Jurang, churang	Khlong, Glohng
Harbour	Waráya	Turai mukam	Bandar	—	Labuan	—
Hill	Hela	Médu, kunru	Giri, pahar	—	Bukit	Khao
Island	—	Tivu	Jinjira, dwip, lanka, tapu	Gyun, kyun	Pulau	Kò (Goh)
Lagoon, fresh water	Miridiya kalapuwa	—	—	—	—	—
Lagoon, salt water	Karadiya kalapuwa	—	—	—	—	—
Lake	Wila, wewa	Éri, vávi	Káyal	In	Danau, tasik	—
Mountain	Kanda	Malai	Giri, pahar	Taung	Gunong	Khao
Passage	—	—	—	—	—	Chong
Point	Désatuduwa	Munai	Karu	Maw	Ujong, tanjong	Hlæm (Lem)
Reef, coral	Koral, para	Sallippár	—	—	—	—
Reef, rocky	Gal porra	Katpár, paar	—	—	—	—
River	Ganga, oya	Aru, ar	Ar khári	Myit	Gusong Sungei, kali	—
River mouth	Gan móya, modara	Mukathuváram	—	—	Kuala, muara	Pak
Rock.	Parvata	Kallú, kal	Chatan	Kyauk	Batu	Hin
Sand bank	—	Manthiddi	Balu danda	—	Beting	—
Sea	Muhuda	Kadal	Kala pani	—	Laut	—
Shore	Werala	—	—	—	—	—
Stone	Gala	Kal, kallu	—	Kyauk	Batu	—
Town	Nuwara, nagaraya	—	Bara gam	Myo, daung	Negri	Ban
Village	Lokugama	Periyakirámam	Chota gam	Yua	Kampong	Bang

SYSTEM OF ORTHOGRAPHY

The following rules for the spelling of geographical names (termed the R.G.S. II system) have been adopted for British official use, and the names in Admiralty Hydrographic publications will be rendered in accordance with these rules as opportunity occurs.

In new editions of the various volumes of sailing directions names are, generally speaking, given in accordance with these rules, but where the name on the chart shows an older rendering of a name, such chart name is given in brackets after the new rendering and will also be given in the Index.

The rules for spelling in the R.G.S. II system are as follows :—

- (1) The spelling of every place-name in an independent country or self-governing dominion using the Roman alphabet (including "Roman" alphabets containing extra or modified letters, such as Czech, Serb-Croat, Polish, Romanian, etc.) shall be that adopted by the country or dominion.
- (2) In colonial possessions the spelling of such place-names as belong to languages coming under Rule (1) will be spelt in accordance with that rule.
- (3) The accents and diacritical marks in official use by the above countries will be retained. Wherever it appears desirable, the pronunciation will be shown by giving the name as transliterated on the system below.
- (4) All other place-names throughout the world will be spelled in general accordance with the following system.

The broad features of this system are

- (a) That vowels are pronounced as in Italian and consonants as in English :
- (b) That every letter is pronounced, and no redundant letters are used.

This system aims at giving a close approximation to the *local* pronunciation ; but it is recognised that in some languages, notably Russian, Greek, and Arabic, the necessity for letter-for-letter transliteration often renders this impossible.

TABLE OF SPELLING AND PRONUNCIATION R.G.S. II.

a	The long and short Italian vowels, as in <i>lāvā</i> ..	Somāli; Rāvennā.*
ā	Between <i>a</i> in <i>fat</i> and <i>e</i> in <i>eh</i> ?; chiefly in Teutonic and Finno-Ugrian languages	Mähring; Pärnu.
ai	The two Italian vowels, frequently diphthongal, almost as in <i>aisle</i> ; but pronounced <i>ei</i> and <i>ē</i> in Greek names.. .. .	Wadai; Shanghai.
au	The two Italian vowels; frequently diphthongal; almost as <i>ou</i> in <i>out</i>	Sakau; Bauchi.
aw	When followed by a consonant, or when terminal, as in <i>awl</i> , <i>law</i>	Dawna; Saginaw.
b	As in English.	
c	Not to be used, but always replaced by <i>k</i> or <i>s</i> ; except in the compound <i>ch</i> , and in many conventionally-spelt words, as	Kandahar; Serang. Calcutta; Célebes.
ch	As in <i>church</i> ; never <i>tch</i> or <i>tsch</i> for this sound ..	Chad; Kerch.
d†	As in English.	
dh	Soft <i>th</i> as in <i>they</i> ; a slight <i>d</i> sound sometimes preceding it in Semitic languages	Hadhramaut; Riyadh.
e	Long as in <i>eh</i> ? short as in <i>bet</i> . (For the <i>e</i> sound in the French <i>je</i> , see note at end on the "neutral vowel.")	Gēlo; Mafeking.*
(ee)	Used for <i>i</i> (<i>q.v.</i>) only in a few conventional names	Darjeeling; Keelung.
ei	The two Italian vowels, frequently diphthongal as in <i>rein</i> , but pronounced <i>i</i> in Greek names ..	Beirut; Raheita.
(eu)	Not used as a single sound.	
f	As in English; <i>ph</i> must not be used for this sound	Mustafa; Maidan-i-Naftun.
g	Hard, as in <i>get</i> , <i>gift</i> : never as in <i>gem</i> , <i>gin</i> ..	Gedāref; Gilgit.
gh	Soft guttural, the Arabic <i>ghain</i>	Ghadames; Baghdad.
h	Used only when sounded; or in the compounds <i>ch</i> , <i>dh</i> , <i>gh</i> , <i>hh</i> , <i>sh</i> , <i>th</i> , <i>zh</i>	Ahmadabad; Abdullah.
i	Long as in <i>marine</i> ; short as in <i>piano</i>	Fiji; Kibonde.
j	As in English; except in transcription of Chinese, where it equals <i>zh</i> , or the French <i>j</i>	Juba, Ujiji (Eng. <i>j</i>); but Jaoping (Fr. <i>j</i>).
k	As in English; hard <i>c</i> should never be used (except in conventionally-spelt words)—thus, not <i>Corea</i> , <i>Cabul</i> , but	Korea; Kabul.
kh	Hard aspirated guttural, as in the Scottish <i>loch</i> (not as in <i>lock</i>)	Khan; Sebkhā.
l† m† n†	} As in English.	

*The long and short symbols given here are merely for explanation, not for use.

†See note at end on *Liquid Sounds*.

- ng** Has three separate sounds, as in *vanguard*, *finger*, and *singer*. If necessary to distinguish, a hyphen may be placed, as in *van-guard*, *singer* .. In-galla; Bongo; Ng-ami; Tong-a.
- ngg** May be used for the sound of *ng* as in *finger* .. Trengganu; Yanggang-a.
- o** Long as in *both*¶: short as in *rotund* Kigōma; Hōnōlulu.*
- ō** As in German; equals the French *eu* in *peu*; or nearly the English sound in *fur* Barkōl.
- (oo)** Used for *u* (*q.v.*) only in a few conventional names, chiefly Indian and Chinese Poona; Foochow.
- oi** The two Italian vowels; frequently diphthongal as in *oil*, but pronounced like *i* in *fit* in Greek names Hanoi.
- ōi** The diphthong as in French *oeil* and Norwegian *høi* Hōiland.
- ou** Dissyllabic, and not as French or English *ou*, except in Greek names where it has the French value Zlatoust; Yaroua.
- ow** Used as a diphthongal combination of *ō* and *w* only in the romanisation of Chinese Hankow.
- p** As in English.
- ph** As in *loophole*; not to be used for the *f*-sound, except conventionally Chemulpho; Haiphong.
- q** Represents *only* the Arabic *qaf* and the Hebrew *qof*; i.e. a guttural *k* (as a rule) Qena; Qiryath.
- qu** Should never be employed to represent the sound of *kw*; thus, not Namaqua, Quorra, but Namakwa; Kworra.
- r** As in English; should be distinctly pronounced.
- s†** As English *ss* in *boss*, not as in *these* or *pleasure* Burgos; Masikesi.
- sch** As in *discharge* Peschanka.
- sh**
†t } As in English.
- th** Hard *th* as in *thick*, not as in *this* (except conventionally in Fijian) 'Athlith; Thingvellir.
- u** Long as in *rude*, or as *oo* in *boot*; short as in *pull* Zūlfū; Rūanda.*
- ū** As in German: equals the French *u*, as in *tu* (Fr.) Ūskūdar.
- v**
w
x } As in English.
- y** Always a consonant, as in *yard*; it should not be used as a terminal vowel, *e* or *i* being substituted; e.g. not Kwaly or Wady, but Kwale; Wadi.
- z** As in *gaze*, not as in *azure*.
- zh** As the *s* in *treasure*, the *z* in *azure*, or the French *j* in *je*; but for the sound in Chinese use *j* (*vide* note under *j*) Zhob.

*The long and short symbols given here are merely for explanation, not for use.

†See note at end on *Liquid sounds*.

¶The true Italian *ō* is broader than this; almost as in *broth* (= R.G.S. II *aw*). The letter *o* is conventionally used for this sound in certain names in Nigeria Tonga, etc.: e.g. Oyo, Fofoa.

NOTES.

The doubling of a vowel or a consonant is only necessary when there is a distinct repetition of the single sound, and should otherwise be avoided

Nuusafee; Moorea;
Jidda; Muhammad.

Accents should not generally be employed; but in order to indicate or emphasise the stress, an acute accent may be used

Saráwak; Qántara;
Tong-atábu; Paraná.

A long or short mark over a vowel (e.g. *ā*, *ō*) should only be used (and that sparingly) when without it there would be danger of mispronunciation ..

Kât; Kyôto; Abôso.

Hyphens will not be used except to indicate pronunciation and with the particle *-i-* (in Persian, Fijian, etc.)

Ta-if; Pusht-i-Kuh;
Nuku-i-Ra.

Inverted comma and apostrophe.—The inverted comma ' is employed only to represent the Arabic '*ain*', the Maltese '*ghain*', and the Hebrew '*ayin*'. The apostrophe ' in foreign words indicates a liquid sound (*see* below).

Liquid sounds.—The occasional "liquid" or "palatalised" sound of *d*, *l*, *n*, *s*, *t*, etc. (as in *d'you*, *lure*, *new*, *pursue*, *tune*, etc.) is as a rule sufficiently represented by a following *y*; where, however, owing to a following consonant, or to the palatalised letter coming at the end of a word, the *y* is inapplicable, the liquid sound will be represented by an apostrophe, thus: *d'*, *l'*, *n'*, *s'*, *t'*, etc.

The "Neutral vowel."—The "indeterminate" or "neutral" vowel sound (*er*), i.e. the sound of *a* in *marine*, *e* in *often*, *i* in *stir*, *io* in *nation*, *o* in *connect*, *ou* in *curious*, *u* in *difficult*, etc., *e* in French *je*, or the often unwritten vowel (*Fat-ha*) in Arabic, etc., is represented as a rule by *a*: as in Basra, Hawiya; but sometimes by *e*, when the sound approximates more to *e* than to *a*: as Meshed, El Gezira.

(In any guide to pronunciation issued by the Permanent Committee on Geographical Names, the "neutral vowel" is represented generally by the italic *e*: occasionally also by italic *a* or *u*.)

This sound must not be confused with *e-mute*, where the *e* is not sounded at all: as in Abbeville.

Nasal vowels.—In illustrating the pronunciation of French, Portuguese, Polish, etc., nasal vowels, the nasalisation will be represented by italic *n*; as Czestochowa pr. Chănstokhóva.

Note.—The Royal Geographical Society has published a book entitled "Alphabets of Foreign Languages transcribed into English according to the R.G.S. II system." This book enables the correct rendering of names to be obtained, also of names in languages which are transliterated letter for letter.

LAWS AND REGULATIONS APPERTAINING TO NAVIGATION.

While, in the interests of the safety of shipping, the Admiralty make every endeavour to include in their hydrographic publications details of the laws and regulations of all countries appertaining to navigation, it must be clearly understood :—

- (a) *that no liability whatever can be accepted for failure to publish details of any particular law or regulation, and*
- (b) *that publication of the details of a law or regulation is solely for the safety and convenience of shipping and implies no recognition of the international validity of the law or regulation.*

INFORMATION RELATING TO ADMIRALTY CHARTS AND PUBLICATIONS, GENERAL NAVIGATION, AND GENERAL METEOROLOGY.

ON THE CORRECTION OF ADMIRALTY CHARTS.

Guides to Navigation.—In addition to the charts, the navigational publications which are primarily affected by the continual changes and alterations that take place are the Admiralty Sailing Directions, the Admiralty List of Lights, Fog Signals and Visual Time Signals, and the Admiralty List of Radio Signals. The Admiralty Notices to Mariners contain information mainly for the correction of the charts and navigational publications.

CHARTS.

1. Degree of Reliance.—It should be clearly understood that the value of a chart depends on the character of the original survey and on the completeness of the reports of subsequent changes. The remarks on "The Use of Charts as Navigational Aids, &c." which are subjoined should be carefully studied in this connection.

2. System of Dating and Issue of Corrected Copies.—Admiralty charts after first publication are kept corrected by means of new editions, large corrections, and small corrections. Copies of charts issued by the Hydrographic Supplies Establishment, Admiralty Chart Agents or Admiralty Chart Depôts are corrected, except from temporary and preliminary Notices to Mariners, for all navigational information to the date of issue.

New Charts.—The date of publication of a chart is shown outside the bottom margin, in the middle, e.g. :—

Published at the Admiralty 30th May, 1947.

New Editions.—When a chart is revised throughout and modernised in style a new edition is published, the date being shown outside the bottom margin and to the right of the date of publication, e.g. :—

New Edition 2nd Jan., 1947.

All large and small corrections notations are at the same time erased, and all old copies of the charts are cancelled.

Large Corrections.—When a chart is corrected from important information which is too comprehensive to promulgate by Admiralty Notice to Mariners or to insert conveniently by hand on existing

copies, but when the chart is not revised throughout, the date on which these corrections are made is shown on the chart outside the bottom margin and to the right of the date of publication, and in the case of a chart already marked with a new edition date, below such date, e.g. :—

Large corrections 10th Feb., 1947.

All small corrections notations are at the same time erased, and all copies of the chart are cancelled.

10 *Small corrections.*—

- (i) When a chart is corrected from the information promulgated in an Admiralty Notice to Mariners (except temporary and preliminary Notices), the year, if not already shown, and number of the notice are entered in the bottom left-hand corner of the chart, e.g. :—

Small corrections 1947–903.

Copies of the chart stocked by the Hydrographic Supplies Establishment, Admiralty Chart Agents and the Admiralty Chart Depôts are corrected by hand from such information.

- 20 (ii) When a chart is corrected from information which is considered of no importance from the standpoint of safe navigation, and which is, therefore, not promulgated in an Admiralty Notice to Mariners, the year, if not already shown, and date of the correction are entered on the chart, in one of two ways, in the bottom left-hand corner below the margin and in sequence, with the notations referred to in the preceding paragraph, e.g. :—

Small corrections, 1947—5.20—

or Small corrections 1947—(VI.25)

- 30 These indicate that the chart received minor corrections on the 20th May or 25th June, respectively.

In such cases copies of the chart held by ships and establishments are not usually replaced by new copies, but in exceptional cases, e.g., when new compasses are inserted, new copies of the charts may be supplied. It should, however, be particularly noted that the absence of corrections represented by square or bracket dates from a chart does not invalidate it for navigation.

3. **Correction of Charts in Ships.**—All small but important corrections affecting navigation that can be made to the charts by hand are promulgated in Admiralty Notices to Mariners and, with the exception of corrections from temporary or preliminary Notices, should at once be neatly made in waterproof violet ink on the charts affected, the year (if not already shown) and numbers of the notices being inserted, also in waterproof violet ink, in the bottom left-hand corner of the chart. The recognised abbreviations shown on Admiralty chart No. 5011 ("Signs and abbreviations used on Admiralty Charts") should be used.

Generally speaking, the amount of information which should be inserted on a chart should be in accordance with that already shown.

On large scale charts, the abridged descriptions, as shown on chart No. 5011, of all details of all lights, light-buoys and fog signals, and the year dates of obstructions, reported shoals, dredged channels,

depth on bars or in shifting channels, and irregularities of lights, should be inserted.

On coastal charts, the abridged descriptions of only the principal lights and fog-signals, i.e., those to assist in approaching or making the land, should be inserted. 5

Particulars of such lights should be omitted, in the following order, as the scale of the chart decreases, viz. :—

- (i) Elevation, (ii) Period, (iii) Number in Group, and (iv) Visibility.

Particulars of fog signals should be inserted in their appropriate positions if space permits, but should otherwise be entered in a tabulated list under the title or some other convenient place on the chart. 10

Inner harbour light-buoys and beacons should not be inserted on coastal charts, and against other light-buoys only the character of the light should be inserted. 15

On ocean charts, lights which are visible 15 miles or over should alone be inserted and then only their character and colour.

On all charts, writing should be inserted as much as possible clear of the water, unless the relative objects are on the water, and care should be taken not to obliterate any information already on the chart. When cautionary or tidal notes, &c., are inserted, they should be written in a convenient but *conspicuous* place, preferably near the title, where they will not interfere with other details. 20

Erasures should never be made but the details should, when necessary, be crossed through in waterproof violet ink. 25

Admiralty Notices to Mariners are occasionally accompanied by reproductions of portions of charts (known as “blocks”), and when correcting charts from such blocks the following points should be borne in mind :—

- (i) A block may not only indicate the insertion of new information, *but also the omission of matter previously shown*. The latter would, however, invariably be mentioned in the text of the Notice, and the fact that a block accompanies a Notice should not cause the text of the Notice to be disregarded. 30
- (ii) The limiting lines of a block are determined for convenience of reproduction and need not be adhered to when cutting out for pasting on the chart, provided that the point mentioned in the preceding paragraph is taken into consideration. 35
- (iii) The new information shown on a block can sometimes be inserted on the chart by hand, the reason for issuing a block in such a case being to avoid a long description of the new information in the text of the Notice. 40
- (iv) Owing to distortion the blocks do not always fit the charts exactly, care should therefore be taken when pasting a block on to a chart that the more important navigational corrections fit as closely as possible. This can best be assured by fitting the block while it is dry and making two or three pencil ticks round the edges for use as fitting marks after the paste is applied. 45

Corrections from Temporary or Preliminary Notices to Mariners should be inserted on the charts *in pencil* and the year and number of the notice should be shown against them, e.g. :—N.M. 625/1947 temp., and also in the bottom left-hand corner of the chart, in pencil, 55

below the small corrections notations (*see above*). Temporary corrections should be rubbed out when the notice is received cancelling them, but preliminary corrections should be inked in when the notice is received reporting that the changes have been made.

- 6 Charts stocked by the Hydrographic Supplies Establishment, Admiralty Chart Agents and the Admiralty Chart Depôts are *not* corrected from Temporary or Preliminary Notices to Mariners, and when charts are received from one of these sources they should be corrected in pencil as necessary from the copies of such Notices already
10 held, or from those supplied with the charts.

Corrections from Radio Navigational Warnings concerning derelicts and drifting obstructions, the temporary extinction of lights, displacement of important aids to navigation, ice reports, &c., should also be noted *in pencil*, as received, on the charts affected. Radio Navigational
15 Warnings of a permanent nature and those relating to derelicts and drifting obstructions dangerous to navigation are re-issued in the form of Admiralty Notices to Mariners, but other warnings are not re-issued in this way, except in special circumstances.

- Corrections from information received from authorities other than
20 the Admiralty should be noted, *in pencil*, on the charts affected, but no charted danger is to be expunged without the authority of the Hydrographer of the Navy.

NAVIGATIONAL PUBLICATIONS.

1. **Admiralty Sailing Directions, Supplements, &c.**—The
25 Admiralty Sailing Directions, consisting of about 73 volumes for the whole world, contain general information useful to the navigator.

An index chart bound near the beginning of each volume shows the area dealt with and the serial numbers and limits of all Admiralty charts for the area which were published *when the volume was printed*.

- 30 Each volume is periodically revised throughout, and, in the intervals between the publication of new editions, Admiralty Notices to Mariners and Supplements are published to enable the volume to be corrected. It should, however, be clearly understood that Sailing Directions cannot be correct in all minor details after the date of the latest Supplement.

- 35 The above-mentioned corrections are not made in the Sailing Directions stocked by the Hydrographic Supplies Establishment, Admiralty Chart Agents or the Admiralty Chart Depôts.

- A new edition of each volume of Sailing Directions is published at intervals of approximately from ten to twelve years. The number
40 of the latest Admiralty Notice to Mariners used in its compilation is given in the "Advertisement" on page iii of each volume, and the numbers of the Notices affecting it between the dates of going to press and issue to ships and establishments are given in the Notice announcing its publication, to enable the new edition to be corrected
45 before being brought into use.

- A Supplement to each volume is generally published annually, each succeeding Supplement cancelling the former. When a volume is taken up for revision, however, no further Supplement to that edition is issued, but subsequent Notices to Mariners affecting it are summar-
50 ised each year and issued as a separate publication, until the new edition of the volume is published.

A tabular form for notation of the existence of Supplements and Summaries of Notices is printed on the front fly-leaf of all Sailing

Directions, and these notations are made as necessary in all copies issued by the Hydrographic Supplies Establishment and the Admiralty Chart Depôts.

Supplements and Summaries of Admiralty Notices to Mariners should be retained intact. *Whenever reference is made to the Sailing Directions, the Supplement, and where applicable the Summary, must be consulted.* The existence of a Supplement or Summary of Admiralty Notices to Mariners is to be entered in the tabular form inside the cover of the Sailing Directions. New and amended information appearing in the Supplements for the first time is indicated by square brackets, and deletions from the previous Supplement are indicated by horizontal lines.

Admiralty Notices to Mariners affecting Sailing Directions *are not* to be cut up and pasted in, but the book is to be annotated in the margin, or corrected in manuscript, as convenient.

2. The Admiralty List of Lights, Fog Signals and Visual Time Signals.—The Admiralty List of Lights, Fog Signals and Visual Time Signals for the world is issued in twelve volumes divided geographically as shown on the index chart at the beginning of each volume.

Light-buoys are *not* included in the list.

The volumes are published annually at the rate of one volume per month commencing with Volume I about March and ending with Volume 12 about February. Supplements to these volumes will not be issued.

Each volume will be issued with an inscription on its cover and title page stating the date to which the volume has been corrected, which will be approximately six weeks prior to the date of its issue. Corrections or additions to each volume, which may occur between the date of correction and date of issue, will be promulgated by Section III of Admiralty Notices to Mariners.

Amendments.—Important amendments are promulgated in Admiralty Notices to Mariners. In Section III of each Weekly Complete Edition of these Notices will be found all additions and alterations made to Lights, Fog Signals and Visual Time Signals by the Notices issued during the week affected; certain other additions and alterations are also included in Section III, which, though not of sufficient importance to necessitate the issue of a Notice to Mariners, will be found of use to the seaman.

Corrections to the Light Lists should be made in pencil, or extracted from Section III and pasted in the appropriate volume.

Note.—Corrections are not made in copies of the Lists of Lights, &c., stocked by the Hydrographic Supplies Establishment, Admiralty Chart Agents or the Admiralty Chart Depôts, and copies received from these sources should accordingly be corrected from the weekly editions of the Notices to Mariners before being brought into use.

3. The Admiralty List of Radio Signals.—The Admiralty List of Radio Signals is issued in three volumes.

Volume I.—Communications—Comprises particulars of radiotelegraph coast stations, together with general regulations; it also includes such subsidiary services as medical advice supplied by radio.

Volume II.—Navigational Aids—Comprises particulars of services from direction-finding stations, radiobeacons, and radio navigational aids (position fixing systems) together with radio time signals and navigational warnings (with ice signals); all relevant codes and regulations will be found in this volume.

Volume III.—Meteorological Services—Comprises particulars of

weather services provided for the use of shipping, together with relevant codes and lists of meteorological observation stations.

New editions of each volume will normally be published annually.

All corrections subsequent to the date of publication are promulgated in Section VI of the complete weekly edition of Admiralty Notices to Mariners.

Copies of the List stocked by the Hydrographic Supplies Establishment, Admiralty Chart Agents or the Admiralty Chart Depôts are not kept corrected, and Lists received from these sources should accordingly be corrected from the weekly editions of the Admiralty Notices to Mariners before being brought into use.

4. The Admiralty Tide Tables.—The Admiralty Tide Tables are published in three sections as follows:—

For "EUROPEAN WATERS (including Mediterranean Sea)."

15 For "ATLANTIC AND INDIAN OCEANS."

For "PACIFIC OCEAN AND ADJACENT SEAS."

Each section contains two parts, Part I giving tidal predictions for Standard Ports and tidal stream predictions for certain straits and channels. Part II giving data for predicting tides at places which are not Standard Ports.

Admiralty Tide Tables, Part III, contains instructions for predicting tides and tidal streams, and for analysing observations of tides and tidal streams, with tables to assist prediction and analysis.

25 THE USE OF CHARTS AS NAVIGATIONAL AIDS AND GENERAL REMARKS RELATING TO PRACTICAL NAVIGATION.

(1) **Reliance on a chart.**—The value of a chart must manifestly depend upon the accuracy of the survey on which it is based, and this becomes more important the larger the scale of the chart.

30 To estimate this the date of the survey, which is always given in the title, is a good guide. Besides the changes that, in waters where sand or mud prevails, may have taken place since the date of the survey, the earlier surveys were mostly made under circumstances that precluded great accuracy of detail, and, until a plan founded on such a survey is tested, it should be regarded with caution. It may, indeed, be said that, except in well-frequented harbours and their approaches, no surveys yet made have been so minute in their examination of the bottom as to make it certain that all dangers have been found. The fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed, it may be taken for granted that the survey was not in great detail.

It appears to be insufficiently realised that the degree of reliance which may reasonably be placed upon an Admiralty chart, even in surveys of modern date, is mainly dependent on the scale on which the survey was made. The scale for publication is now generally that of the original survey, except in the case of coast sheets which are sometimes reduced. It should not, therefore, be assumed that the original survey was made on a larger scale than that published.

50 It must be borne in mind that the principal method of ascertaining the inequality of the bottom of the sea is by the laborious process of sounding, and that in sounding over any area, the boat or vessel

obtaining the soundings is kept on given lines ; that each time the lead descends, or a sonic sounding is taken, the depth over only a small area is obtained, in the case of the lead, it has a diameter of only a few inches, and that consequently each line of soundings, though miles in length, is only to be considered as representing a narrow width. 5

Surveys are not made on uniform scales, but each survey is made on a scale commensurate with its apparent importance. For instance, a general survey of a coast which vessels only pass in proceeding from one place to another is not usually made on a scale larger than one inch to the nautical mile, while surveys of areas where vessels are likely to anchor are made on a scale of three inches to the mile, and surveys of frequented ports or harbours likely to be used by fleets, on a scale of from six inches to ten inches to the nautical mile. 15

Close examination by sounding is the only method by which surveys on a large scale can be made, and in view of the vast mileage of surveys yet requiring completion in the interests of navigation, it would be a waste of time to undertake large-scale coast surveys.

The scale on which a survey is to be conducted having been settled, 20 it is manifestly superfluous to obtain more lines of soundings than can be represented on the paper. 100 soundings, which is the maximum number that can be placed with clearness on every square inch of paper, means that on a scale of one inch to the mile each sounding on the chart occupies an area representing eight acres of actual ground, 25 whilst on a scale of six inches to the mile each sounding represents an area of a little less than a quarter of an acre, i.e., of 100 feet square.

The following diagram represents as many soundings as can be placed legibly on a square inch of paper :— 30

16	15	13	13	14	12	11	10	9
14	15	14	14	13	12	11	9	8
15	15	14	17	16	14	13	10	9
16	16	17	18	16	12	11	8	9
18	17	15	12	9	7	7	7	9
19	16	12	9	5	4	5	6	8
22	19	16	10	3	5	6	7	8
20	16	12	7	5	6	6	7	8
18	15	11	9	7	7	8	10	11
20	17	14	11	12	10	9	10	11

Little assistance in detecting excrescences on the bottom is afforded by the eye, when sounding in a boat, even in clear water, on account of the observer being within five feet of the surface ; none in turbid seas. If, therefore, there is no inequality in the soundings to cause suspicion, a shoal patch between two lines may escape detection. 35

Thus, in a chart on a scale of one inch to the mile, an inequality of some acres in extent rising close to the surface, if it happened to be situated between two lines, might escape detection ; whilst in a chart on a scale of 6 inches, inequalities as large as battleships, if lying parallel with, and between the lines of soundings, might exist 40 without detection if they rose abruptly from an otherwise even bottom.

General coast charts should not, therefore, be looked upon as infallible, and a rocky shore should on no account be approached within the ten-fathom contour line, without taking every precaution to avoid a possible danger ; and even with surveys of harbours 45 on a scale of 6 inches to the mile vessels should avoid, if possible,

passing over charted inequalities in the ground, as some isolated rocks are so sharp that the lead may not find the highest part. Better results can, however, be obtained by sonic sounding owing to the rapidity with which such soundings can be taken, but even
5 this method will not find rocks unless the boat or vessel be directly over them.

Blank spaces among soundings mean that no soundings have been obtained in these spots. When the surrounding soundings are deep it may with fairness be assumed that in the blanks the water
10 is also deep; but when they are shallow, or it can be seen from the rest of the chart that reefs or banks are present, such blanks should be regarded with suspicion.

Soundings in hair line, which are shown on the latest charts in upright figures, and on other charts in sloping figures, indicate that
15 such soundings have been taken from smaller scale charts, an unreliable source, or adapted from old and imperfect surveys.

(2) **Fathom lines a caution.**—Except in plans of harbours that have been surveyed in detail, the six-fathom line on most Admiralty charts is to be considered as a caution or danger line against unneces-
20 sarily approaching the shore or bank within that line, on account of the possibility of the existence of undiscovered inequalities of the bottom, which nothing but an elaborate detailed survey could reveal. In general surveys of coasts or of little frequented anchorages, the necessities of navigation do not demand the great expenditure of time
25 required for such a detailed survey. It is not contemplated that ships will approach the shore in such localities without taking special precautions.

The ten-fathom line is, on rocky shores, as before mentioned, another warning, especially for ships of deep draught.

30 Charts on which no fathom lines are marked must be especially regarded with caution, as it generally means that soundings were too scanty and the bottom too uneven to enable them to be drawn with accuracy.

Isolated soundings, shoaler than surrounding depths, should always
35 be avoided as there is no knowing how closely the spot may have been examined.

(3) **Chart on largest scale always to be used.**—It sometimes happens that from press of work, only the copper plate of the larger scale chart of a particular locality can at once receive any extensive
40 re-arrangement of coastline or sounding. This is an additional reason, besides the obvious one of the greater detail shown, why this largest scale chart should always be used for navigating.

(4) **Caution in using small-scale charts.**—In approaching the land or dangerous banks, regard must always be had to the scale of the
45 chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile.

For the same reason bearings to near objects should be used in preference to objects farther off, although the latter may be more
50 prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

(5) **Graduation.**—All plans are now being graduated in skeleton style before publication in order to facilitate easy reference to astro-
55 nomical positions; previously published plans are also graduated as opportunity offers. The graduation is, however, of necessity often

based upon imperfect information of a conflicting nature; for this reason, whenever an astronomical position is quoted other than approximate (i.e., when seconds are given), it is necessary to quote also the number of the particular chart from which the position has been derived.

In this connection it is pointed out that, whenever possible, a position should be transferred from one chart to another by bearing and distance from a distinguishing feature common to both, such as a point of land or a light, &c., and not by the graduation which may differ owing to one of the charts being constructed on later and more complete astronomical data than the other.

(6) **Distortion of printed charts.**—The paper on which charts are printed is, from various causes, subject to distortion, but the effect of this is seldom sufficient to affect navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree when carefully plotted upon the chart, especially if the lines are to objects at some distance. The larger the chart the greater the amount of this distortion.

(7) **Buoys.**—It is manifestly impossible that any reliance can be placed on buoys always maintaining their exact position. Buoys should, therefore, be regarded as warnings and not as infallible navigating marks, especially when in exposed positions; and a ship should always, when possible, be navigated by bearings of fixed objects on shore or angles between them, and not by buoys.

(8) **Light-buoys.**—The lights shown by light-buoys cannot be implicitly relied on, as, if occulting or flashing, the apparatus may get out of order, or the light may be altogether extinguished. These lights in the British isles are from 5 to 217 candle-power.

(9) **Cable-buoys.**—Cable-buoys marking the ends of submarine cables usually are spherical or can-shaped, surmounted by a globe and occasionally a flag. Below the topmark two *white fixed* lights, disposed horizontally, may be exhibited, but they cannot be implicitly relied on.

(10) **Lights.**—Arcs drawn on charts round a light are not intended to give information as to the distance at which it can be seen, but solely to indicate, in the case of lights which do not show the same characteristics or colours in all directions, the bearings between which the differences occur.

All the distances given in the Admiralty List of Lights and on the charts for the visibility of lights are calculated for a height of an observer's eye of 15 feet. The table of distances visible due to elevation, at the beginning of each volume of the Admiralty List of Lights, affords a means of ascertaining how much more or less the light is visible should the height of the eye be more or less. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking out for a light at night, the fact is often forgotten that from aloft the range of vision is much increased. By noting a star immediately over the light a very correct bearing may be afterwards obtained from the compass.

The intrinsic power of a light should always be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by remarking its candle

power, as given in the Admiralty List of Lights, and in some cases by noting how much its visibility in clear weather falls short of the range due to the elevation at which it is placed. Thus, a light standing 200 feet above the sea, and only recorded as visible at 10 miles in clear weather, is manifestly of little brilliancy, as its elevation would permit it to be seen over 20 miles, if of any power. (See table in the Admiralty List of Lights.)

The distance from a light cannot be estimated either by its brilliancy or its dimness.

10 On first making a light from the bridge, by at once lowering the eye several feet and noting whether the light is made to dip it may be determined whether the vessel is in the circle of visibility corresponding with the usual height of the eye or unexpectedly nearer the light.

(11) **Fog signals.**—Sound is conveyed in a very capricious way through the atmosphere. The following points in regard to fog signals should be borne in mind :—

(a) Fog signals are heard at greatly varying distances.

(b) Under certain conditions of atmosphere, when an air fog signal is a combination of high and low tones one of the notes may be inaudible.

(c) There are occasionally areas around a fog signal in which it is wholly inaudible.

(d) A fog may exist a short distance from a station and not be observable from it, so that the signal may not be sounded.

25 (e) Some fog signals cannot be started at a moment's notice after signs of fog have been observed.

Mariners are therefore warned that fog signals cannot be implicitly relied upon, and that *the practice of sounding should never be neglected*. Particular attention should be given to placing "Look-out men" in positions in which the noises in the ship are least likely to interfere with the hearing of the sound of an air fog signal; as experience shows that, though such a signal may not be heard from the deck or bridge when the engines are moving, it may be heard when the ship is stopped, or from a quiet position. It may sometimes be heard from aloft though not on deck.

Great assistance may be obtained from radio beacons at many important lighthouses and light-vessels, but the attention of Mariners is called to the serious dangers which may arise from their misuse. No attempt should be made to approach such a position on a radio bearing, whilst relying only on hearing the sound fog signal in sufficient time to alter course to avoid danger. When the radio fog signal is transmitted from a light-vessel, it is essential in order to avoid collision, that the bearing from the light-vessel should not be kept constant.

(12) **Tides.**—In navigating coastal waters where the range of the tide is considerable, caution is always necessary. The tidal predictions for Standard ports in the Admiralty Tide Tables can generally be relied upon to give the times of high and low water to within a few minutes, and heights within a few tenths of a foot. Larger errors are to be expected in the predictions for places which are not Standard ports, computed from the data in Part II, but such predictions computed from the harmonic constants are always sufficiently accurate for the general requirements of navigation. For Standard ports the heights of the tide at times between high and low water may usually be found within narrow limits in accordance with the instructions in Parts I and III of the Tide Tables.

The datums of Admiralty charts depending on Admiralty surveys

vary with the type of tide, but usually conform with the International agreement, that datum should be "a plane so low that the tide will but seldom fall below it." The datums used by different nations, however, differ very considerably and those of Admiralty charts depending on foreign surveys are always those used by the original surveyors, which vary from "lowest possible low water" to "mean low water" in tidal waters, and are usually mean sea level in non-tidal waters.

The datum used is always stated on large-scale Admiralty charts.

Caution.—Most datums are above the lowest level to which the tide may fall; the charts therefore do not always show minimum depths.

(13) **Tidal streams.**—Where the tidal streams are semi-diurnal information regarding them is usually given, in a convenient part of the chart, in tabular form or by notes, special symbols being inserted at the positions to which the information refers. In certain cases, where the information available is incomplete, the streams are indicated by means of arrows.

There are many places where the tidal streams cannot be predicted by reference to the tide at a Standard port. Although no data for predicting the times at which they flow is given, their general direction is, in many cases, indicated by arrows on the charts. For a few of the straits and channels, where these conditions exist, tidal stream predictions are given in Admiralty Tide Tables.

Tidal streams, particularly if rotary, may vary considerably both in direction and rate; predictions of the stream must therefore always be considered approximate.

The turn of the tidal stream is not usually coincident with the times of high and low water; in fact, though in estuaries, harbour entrances, &c., the stream usually turns at about the times of high and low water, in open channels, and along open coasts generally, the turn usually occurs more nearly at half-tide. Predictions of the times of high and low water must therefore never be used as predictions of the times of slack water.

It should be remembered that, even where the general direction of the stream is parallel with the shore, an indraught is usually experienced when crossing the entrances to bays and inlets.

(14) **Fixing positions.**—For further information on this subject, see Admiralty Manual of Navigation.

When in sight of land, every opportunity should be taken of fixing the ship's position by terrestrial objects.

(a) *Simultaneous bearings or angles.*—The most usual method is by compass bearings of suitable objects, and it must be borne in mind that a fix by only two bearings is liable to error, either an absolute error in taking the bearings, or those made in applying the deviation or in laying the bearings off on the chart. For these reasons, a third or check bearing of some other object should, when possible, be taken, especially when near the shore or dangers. The coincidence of the resulting three lines will prevent any mistakes if the objects are suitably placed.

The position may also be fixed by observing horizontal angles of well-defined suitably placed objects. These angles may be plotted on the chart with a station-pointer. Two conditions are, however, necessary to its successful employment; first, that the objects be well chosen; and, second, that the observer is skilful and rapid in his use of the sextant and station-pointer. For the former, reference can be made to the pamphlet on the use of the station-pointer,

or to the Admiralty Manual of Navigation ; the latter is only to be obtained by practice.

It will readily be seen that a sextant often offers advantages, as angles can be obtained from any position whence the objects are visible, and the fix is in no way dependent on the compass.

In many narrow waters also, where the objects may yet be at some distance, as in coral harbours or narrow passages among mud banks, navigation by sextant and station-pointer is invaluable, as a true position can only be obtained by its means. A small error in either taking or plotting a bearing under such circumstances may put the ship ashore.

In all cases where great accuracy of position is required, such as the fixing of a rock or shoal, or the addition to a chart of fresh soundings or new buildings, angles should invariably be used. In such cases angles should be taken of a number of objects, five being a good number, since this not only fixes the position beyond doubt, but also affords a useful check on the accuracy of the chart itself. When running a line of soundings it is only necessary to take a third angle every now and then, firstly to make certain that the more important soundings, as at the end of a line, are correctly placed, and secondly to check the general accuracy of the chart.

Sometimes when only one of the selected objects is visible from the compass, a compass bearing of it and a sextant angle to the other may be used to fix the position.

(b) *Simultaneous bearing and distance.*—Attention is also directed to the very useful and handy method of fixing by the bearing and distance of a suitable object.

Should the ship be supplied with ranging equipment, its use here is obvious, but without it a very good approximate distance of an object of known height may be obtained by observing its angle of elevation and obtaining its distance from Lecky's Offshore Distance Tables, which are supplied with all sets of charts. Full directions for the use of these Tables are given with them.

(c) *The running fix.*—If two position lines are obtained at different times the position of the ship may be found by transferring the first position line up to the time of taking the bearing for the second position line. The point of intersection of the second and the transferred position line is the ship's position at the time of the second observation.

The accuracy of this fix will depend on the accuracy of the estimated run (over the ground) between bearings and, therefore, it is essential to take great care that an accurate allowance is made for tidal stream, current, and leeway experienced by the ship during this interval.

The method of fixing by doubling the angle on the bow is useful when passing points of land, &c., in waters where there is either no tidal stream or current, or where this can be estimated with sufficient accuracy.

This method is as follows :—

Suppose that the angle between the ship's head and an object is measured, and found to be X° , and that the time of the observation is noted. Suppose also that the time is again taken when the angle between the ship's head and the object is $2X^\circ$. Then, if the course made good is the course steered, the distance of the ship from the object at the time the second bearing was taken is equal to the run (over the ground) in the interval. Hence the ship's position can at once be laid off as a bearing and distance from the object. In practice the angle X should not be less than about 25° .

The most usual form of this method, the so-called "four-point"

bearing, gives a good fix for a departure, but does not ensure safety, as the point and any dangers that may lie off are abeam before the position is obtained.

The above fix is reliable when there is no tidal stream or current or when it runs directly with or against the course of the ship. When the stream or current runs across the course of the ship or when leeway is to be allowed for, this method should never be used and the ship's position should be obtained by plotting the two bearings as a running fix.

A table "Distance of an object by two bearings" is supplied with certain chart folios, and is also given in Inman's Tables, by which the ship's position at the second bearing can be found: any two bearings at a suitable angle to each other may be used, together with the run between them, but, again, this table should not be used when the vessel is subject to a cross tidal stream or leeway.

(d) *The danger angle.*—The use of the danger angle in passing outlying dangers with land behind them should also not be forgotten.

A vertical danger angle is useful when the danger lies off an object such as a lighthouse, the height of which is known; the angle being obtained from the aforesaid Lecky's Tables. If a horizontal danger angle between two objects is used, however, caution is necessary, as, should the objects not be correctly placed on the chart, the angle taken from it may not serve the purpose. This method should not, therefore, be employed when the survey is old or manifestly imperfect.

(e) *The astronomical position line.*—When fixing by astronomical observations, attention is drawn to the great utility of the position line. Even a single position line may at times give invaluable information, as the ship must be somewhere on this line, provided that the chronometer error is accurately known.

A sounding obtained at the same time may often serve to give an approximate position. Again, by steering along, or at a required distance parallel to, a single position line, a vessel may make her port or avoid a danger, although uncertain of her position.

A very accurate position may be obtained by observations of three or more stars at evening or morning twilight, or by the observation of a bright star at daybreak and another shortly afterwards of the sun when a few degrees (not less than 10°) above the horizon. The position lines obtained from the bodies observed should differ in azimuth by 30° or more.

Mariners are also reminded that, with modern tables for correcting the altitude, observations of the moon entail practically no more calculation than those of a planet. Moon sights are sometimes available when stars are obscured by light cloud, &c.; also, an excellent position may frequently be obtained by simultaneous observations of the sun and moon.

(f) *The radio position line.*—A number of radio systems of which the principal ones are M/F D/F, Radio Beacons, Consol Beacons, Loran, Gee and Decca, are now in general use from which position lines or fixes may be obtained.

The accuracy and range which may be obtained from these systems vary considerably; their great advantage over other methods lies in the fact that they can be employed under all weather and visibility conditions, though in some cases the results obtained will vary between day and night.

Special receiving equipment is generally required in order to make

use of the radio signal, and some systems require special lattice charts or tables for plotting the position lines. Full details of these systems and their coverage areas are contained in Admiralty List of Radio Signals, Volume II.

5 The mariner should appreciate that with the position-fixing systems the accuracy of a fix will depend on three factors :—

(i) The distance of the observer from the transmitters.

(ii) The bearing of the observer from the base line joining the pair of stations which he is using.

10 (iii) The angle of intersection of the hyperbolic position lines.

It should be apparent from the inspection of any lattice chart that an inherent small equipment error, or a small personal error that may occur at the receiver, will cause a geographical error of varying amount according to the observer's position.

15 It is important to realise that accurate equipment is no guard against the vagaries of the propagation of radio waves. The beacons and systems operating on medium and low frequencies are liable to "night error" in areas where the ground and sky waves are received with equal strength; these areas will occur at ranges depending upon the particular frequency used by any beacon or system. Where the transmissions of two stations are synchronised to provide one signal reading and position line, "night error" will be a minimum along the normal to the base line joining the pair of stations, and a maximum towards the limits of their service sector.

25 Little is yet known about the effects of hills and discontinuities in the terrain (such as cliffs) on the speed of medium- and low-frequency radio waves.

At the other end of the radio spectrum the transmissions of systems operating on the very high frequencies are subject to distortion in abnormal atmospheric conditions.

30 (g) *Fixing by radar*.—Radar may also be of considerable assistance when navigating in coastal waters in low visibility or at night. It is essential, however, to appreciate the limitations of a radar set when interpreting the information obtained from it. It must be remembered that the radar horizon is only slightly farther than the visual horizon would be, in good visibility, for a height of eye equal to the height of the radar aerial. Hence no echoes will be received from a coastline lying below the radar horizon, while echoes may be received from high ground farther inland which will give a misleading impression of the range of the nearest land.

40 Depending on the width of its beam, the bearings from a radar set tend to be inaccurate. It is therefore preferable when fixing by radar to use ranges rather than bearings. It is then most important to consider carefully the identity of the object giving the echo, using the bearing as an indication, and the height of the object to determine whether it will appear on the radar presentation. Radar Range Nomograms are useful in deciding this, but a satisfactory result can be obtained by using "Distance to Sea Horizon Tables."

When two or more objects on the radar presentation have been selected and positively identified, a satisfactory fix can be obtained by striking arcs on the chart with the radar range of the selected objects. These arcs intercept at the ship's position. Best results will be obtained by using isolated objects such as detached lighthouses, rocky islets, and the extremities of long piers or jetties, but where no such objects are available a steep coastline with cliffs should be used. Flat or gently shelving coastlines, such as mud flats or sand dunes,

should not be used since it is difficult to identify any portion of them on the radar presentation. Identification is assisted in some areas by fitting objects, such as buoys and beacons, with radar reflectors, causing them to return strong echoes. Attention is drawn to the symbols with which such objects are marked on Admiralty Charts, 5 and which are given in the latest edition of Chart No. 5011, "Explanation of signs and abbreviations used on Admiralty Charts."

The difficulty of positive identification of objects is largely reduced if a Chart Comparison Unit is used in conjunction with the navigational radar. Fixes obtained with this equipment employ, in principle, 10 an infinite number of ranges of the terrain in the vicinity of the ship, and in so doing a satisfactory fix will normally be assured.

In addition, radar beacons are available in some areas. Details of these and their use are given in the Admiralty List of Radio Signals, Volume II. 15

(15) Observations for errors of the compass.—No opportunity should be neglected for checking the error of the compass. When coasting, and a well-surveyed and fairly large-scale chart is available, an excellent method of observing the error is by taking the compass bearing of two suitable objects when in transit, and comparing this 20 with the charted bearing; there should be sufficient distance between the objects to provide a sensitive transit. When this method is not available the error should be obtained by azimuths of a heavenly body. Errors should be observed on any change of course on which the ship is steadied for a reasonable time, and at least twice a day 25 when steering a steady course for long periods.

(16) Change of variation of the compass.—The gradual change in the variation must not be forgotten in laying down positions by bearing on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, 30 and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are re-engraved when the error amounts to a degree, but the chart plates cannot be corrected more frequently from the impossibility of making alterations often on one 35 spot in a copper plate.

The geographical change in the variation is in some parts of the world sufficiently rapid to need consideration. For instance, in approaching Halifax from Newfoundland the variation changes 10° in less than 500 miles, and in the English channel about 5° in 400 miles. 40 The Variation chart should be consulted on this head.

On certain general charts embracing large areas with considerable change of variation, true compasses are placed instead of magnetic compasses, the variation being shown by *isogonic lines* (curves of equal magnetic variation), in a similar manner to the Variation chart. 45 One or two *isogonic lines* are also sometimes placed on charts, in addition to the magnetic compasses, in order to indicate the general direction of these curves, and thus facilitate the determination of the variation to be employed in portions of the chart not in immediate proximity to any one of the engraved compasses. Magnetic variation 50 values shown on Admiralty charts are for the 1st July of the year mentioned.

(17) Local magnetic disturbance of the compass on board ship.—The term "local magnetic disturbance" has reference only to the effects on the compass of magnetic masses external to the ship in 55 which it is placed. Observation shows that such disturbance of the

compass in a ship afloat is experienced only in a few places on the globe. Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such a rapid proportion as the distance
 5 from it increases that it would require a local centre of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic ores in the bed of the sea under the ship, and when the water is shallow, and the force strong, the compass may be temporarily deflected when
 10 passing over such a spot, but the area of disturbance will be small, unless there are many centres near together. Such areas are depicted by a special symbol on charts, and the cause of the magnetic disturbance is referred to as a Local Magnetic Anomaly.

They may also be due to wrecks lying on the bottom in moderate
 15 depths, but investigations have proved that, while deflections of unpredictable amount may be expected when very close to such wrecks, it is unlikely that deflections in excess of 7° will be experienced, nor should the disturbance be felt beyond a distance of 250 yards.

It is very desirable that whenever a ship passes over an area of
 20 local magnetic disturbance, the position should be fixed, and the facts reported as far as they can be ascertained.

(18) Use of oil for modifying the effect of breaking waves.—

Many experiences of late years have shown that the utility of oil for this purpose is undoubted, and the application simple.

25 The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil, skilfully applied, may prevent much damage both to ships (especially the smaller classes) and to boats, by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows :—

30 1. On free waves, i.e., waves in deep water, the effect is greatest.
 2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances; but even here it is of some service.

35 3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. A small quantity of oil suffices, if applied in such a manner
 40 as to spread to windward.

5. It is useful in a ship or boat, both when running, or lying to, or in wearing.

6. No experiences are related of its use when hoisting a boat up in a sea-way at sea, but it is highly probable that much time and
 45 injury to the boat would be saved by its application on such occasions.

At anchor, when the sea is sufficient to render it difficult to hoist up or in boats, oil bags from forward or from the swinging booms have been found to render the sea alongside comparatively smooth.

7. In cold water, the oil, being thickened by the lower temperature,
 50 and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. The best method of application in a ship at sea appears to be : hanging over the side, in such a manner as to be in the water, small canvas bags, capable of holding from one to two gallons of oil, such
 55 bags being pricked with a sail needle to facilitate leakage of the oil.

The position of these bags should vary with the circumstances.

Running before the wind they should be hung on either bow and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying to, the weather bow and another position farther aft seem the best places from which to hang the bags, with a sufficient length of line to permit them to draw to windward, while the ship drifts.

9. Crossing a bar with a flood tide, oil poured overboard and allowed to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect cannot be so much trusted.

On a bar with the ebb tide it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current, and the depth of the water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil is diffused well ahead of the boat, and the bag can be readily hauled on board for refilling if necessary.

12. Towing a vessel in a heavy sea, oil is of the greatest service, and may prevent parting the hawser. Distribute from the towing vessel forward and on both sides; if used only aft the tow alone gets the benefit.

(19) **Mirage and abnormal refraction.**—An unusual lapse rate of temperature (and therefore density as well) with height immediately above the sea (or land) surface produces a distortion in the appearance of objects near the horizon; such a phenomenon is known as mirage.

When the surface is relatively cold (and the wind very light) so that the density of the air decreases rapidly for a short distance above the surface, light rays from objects low down near the horizon are bent down, the same way in fact as are usually the rays of the sun when entering the earth's atmosphere at a low altitude. The effect is to render visible objects that are normally below the horizon, e.g., lights may be "raised" at night at much greater distances than one would ordinarily expect. This phenomenon is known as "looming."

A further occasional effect produced when the air is appreciably warmer than the sea, is "superior mirage" in which an inverted image is seen over the real object; sometimes an erect image is seen immediately above and touching the inverted one. The object and its images in this instance are well defined in contrast to the shimmering object and image of the inferior mirage. Superior mirage is most often experienced in high latitudes and wherever the sea surface temperature is abnormally low.

"Inferior mirage," the effect of which is to decrease the distance at which objects are visible in a horizontal direction, is due to a rapid increase of density with height close to the surface such as occurs when air of comparatively low temperature blows over a warmer sea, or over a tarred road or desert when a hot sun is beating down on it. In either event light rays are bent up when approaching the surface where the density of the air is much less than above. The coastline, and at times a ship or island, may appear to be floating in air above a shimmering horizon, possibly with, in the former instance, her hull

either invisible or with an inverted image underneath. Inferior mirage is comparatively uncommon at sea and is more likely to be observed along a coastline than well out to sea.

- When mirage is evident caution must be used in taking sights with
 5 a sextant, for abnormal refraction must necessarily be present also. With inferior mirage better, but not normal, results will usually be obtained by ascending as high as possible in the ship; with superior mirage the height of eye should be as low as possible. It is, however, advisable, whenever abnormal refraction is suspected, to measure the
 10 elevation of the celestial body above the back as well as the front horizon as explained in navigational text-books.

(20) **Aurora.**—The most common form of aurora is an arc system, single or multiple, narrow and well defined, or broad and diffuse, and centred on the magnetic meridian.

- 15 The most usual colour is pale whitish green when the auroral activity is weak and diffuse: but when the aurora arises high towards the zenith in the form of rays, rayed curtains and draperies with much rapid movement of the constituent rays, the colours sometimes become much stronger and more vivid, and include bright green, red and violet.
 20 When the curtains forming the aurora converge to form a corona, which may rotate very rapidly about the point of convergence, the displays may become very complex, filling practically the whole sky, and extending far to the equatorial side of the zenith with much rapid movement and change of colour from instant to instant.
 25 Though the most usual duration of auroral displays in these high latitudes is several hours, they not infrequently last throughout the whole night from dusk to dawn. In such long displays the really intense and violently active periods with vivid strong colours are generally confined to spasms of 15–30 minutes, with the intervening
 30 periods filled with diffuse glows or quiet arc systems.

- The absolute intensity of the light of the aurora is seldom great, and the brighter stars usually glimmer through it. In the most vivid and intense displays, the light may equal, but rarely surpasses, that of the full moon in a cloudless sky. It may give enough light to read
 35 by. On such occasions the aurora may be visible to some extent in partial twilight.

- Though in high latitudes aurora occurs any time in the dark hours it is probably most frequent in the late evening hours from 9 p.m. till midnight or just after; it is more frequent in the equinoctial months
 40 than at other times and has a well-defined 11-year period of activity following the cycle of solar activity. A maximum of activity occurred in 1948, and the interval from maximum to minimum activity usually occupies a period of about 6 to 7 years. In high latitudes this cycle of activity is reflected more in the intensity and vividness of the displays
 45 than in their frequency of occurrence. Though really outstanding displays tend to occur around the years of maximum activity they may occur at any time of the cycle, except perhaps near the absolute minimum.

- In addition to this 11-year cycle of activity active periods tend to
 50 recur at intervals of 27 days, *see* Magnetic Storms.

- Northern hemisphere.*—Aurora Borealis occurs most frequently along a zone which forms an approximate oval, of average radius 23° , with centre in the extreme north-west of Greenland. This zone of maximum frequency crosses Hudson Bay and the Labrador coast in about lat.
 55 58° N. It runs south of Cape Farewell and along the south coast of Iceland. It lies just north of North Cape, touches the extreme north

of Novaya Zemlya, skirts Cape Chelyuskin and then eastward just north of Wrangel Island into the north of Alaska. Along this zone aurora of some kind can probably be seen every suitable night when the sky is clear; 250 miles outside this maximum zone to the southward the auroral frequency decreases sharply to about 70–100 nights a year on the average, and to 20–25 nights 500 miles south of the maximum zone. Inside the maximum zone the geographical distribution of frequency is not so well established but it probably falls off more gradually than it does outside. 5

On the zone of maximum frequency itself aurora appears as frequently to the south of the zenith as to the north, but with increasing distance outside the zone the appearances concentrate more into the northern sky; the reverse is true inside the zone. 10

Southern hemisphere.—The frequency and distribution of Aurora Australis is not fully known. It is probable that it is more frequently seen at sea between about long. 50° E. and 175° W. than in other longitudes. Very fine displays have occasionally been seen in Australasia and on passages across the Southern Ocean. There is nevertheless a general impression that aurora is less frequent in the southern than in the northern hemisphere. This is probably to be accounted for by the fact that, apart from whaling and exploring expeditions, ships' tracks in general do not extend to such high latitudes as in the northern hemisphere. 15 20

The zone of maximum auroral frequency is roughly annular and is near the circumference of a circle of radius about 1,080 miles, centred in about lat. 75° S., long. 129° E. The frequency falls off both outside and inside this zone. A large part of the zone is within the continent of Antarctica. 25

(21) **Magnetic storms.**—Magnetic storms vary in intensity and frequency with the sunspot cycle, similarly to aurorae. An intense magnetic storm is always accompanied by a bright and active aurora. The deeply coloured aurorae, showing more pronounced red and green, and sometimes also blue and violet, tints, are invariably connected with magnetic storms of considerable or great intensity. Such a storm will produce simultaneous aurora in both hemispheres. In the greatest storms aurorae in some form may be visible down to about 20° north latitude in certain parts of the oceans, especially between the meridians of 30° W. and 140° W. Magnetic storms vary greatly in duration from a few minutes to several days; they are generally more intense during the hours of darkness. Long-continued storms usually show great fluctuations with periods of complete or partial quiescence. Similarly the associated aurora fluctuates between active and quiescent forms. 30 35 40

The origin of magnetic storms and aurorae is not yet fully understood, but they are intimately connected with the state of a local area of the sun. As the same part of the sun is again presented to the earth after an interval of about 27 days, a magnetic storm and aurora may recur at this time, usually in less intense form. 45

A ship's compass may tend to deviate during the progress of a considerable magnetic storm. In more intense storms the compass needle may oscillate 1° or more either side of its normal position. Such oscillation may persist for as long as 10 or 20 minutes before dying out. Further oscillation may occur after a period of quiescence. Deviations of 2° or more are rare, but during the great magnetic storm and aurora of January 25th, 1938, one of 4° to the eastward was observed off the Portuguese coast. During a severe magnetic 50 55

storm the compass may be deflected continually in one direction to the extent of about half a degree for some hours. When bright aurora is seen, especially if it is of the more deeply coloured and rapidly moving kind, and particularly when it is observed in low latitudes, the possibility of deflections of the compass should always be borne in mind.

During a considerable magnetic storm freak wireless reception may occur on certain waves and short-wave transmission may fade to complete silence. Beam radio communication, especially in a west-east or east-west direction, may be interrupted. Such conditions may last in some degree over a period of several days, at times when the sun is unusually active. Short-wave fading also occurs occasionally from a different form of solar disturbance known as a "bright eruption," when this is very intense. On the average such fading begins about 7 minutes after occurrence of the bright eruption and may last 5 or 10 minutes, gradually returning to normal within a period of 40 to 45 minutes. These fadings are confined to the daylight hemisphere of the earth, while the magnetic storm fadings may occur by day or by night.

GENERAL METEOROLOGY.

(All the following articles do not apply to every Pilot, but articles applicable to this Pilot will be referred to in the Climate and Weather Section in Chapter I.)

(1) **Lows.**—A low, or depression, appears on a synoptic chart as a series of isobars roughly circular or oval in shape, surrounding an area of low pressure. It is a main feature of the weather at sea in middle latitudes where it is responsible for most of the occasions of strong winds and unsettled weather, though not all depressions are accompanied by strong winds.

Lows vary very much in size and depth; one may be only a hundred miles in diameter and another over two thousand miles; some are deeper than others, a deep low being one in which the pressure is very much lower near the centre than on the outside whereas, on the other hand, a shallow depression is one where the pressure, although low near the centre, is not very much lower than in the surrounding districts.

Note.—The bracketed equivalents hereunder refer to the Southern Hemisphere.

In the northern (southern) hemisphere the winds blow round an area of low pressure in an anti-clockwise (clockwise) direction; there is also a slight inclination across the isobars towards the lower pressure. Thus the well-known rule for the northern (southern) hemisphere is that when an observer faces the wind the direction of the lowest pressure is from 8 to 12 points to his right (left). The strength of the wind is in all instances closely related to the steepness of the barometric gradient or distance apart of the isobars; the closer the isobars the stronger the wind.

Lows may move in almost any direction, though most often towards north-east (south-east) or east, at a speed of anything between 10 and 40 knots, though occasionally as much as 60, during the middle and most active stage of their existence; they slow down when filling up (see "occlusion" below). The life of a low is in the region of 4 to 6 days.

There are usually one or more fronts, probably radiating from the centre, in the area covered by a low ; each front on a synoptic chart represents a belt of relatively bad weather, accompanied by a veer (backing) of wind, which marks the change from the weather characteristic of one air mass to that of another. During the first two or three days of its life a low has a warm and a cold front, the area between the two being known as a warm sector because the air has come from a warmer locality than that which is outside the sector (*see* Fig. 1*a*). Warm air is lighter than cold air and it rises over the cold air ahead of the warm front as shown in Fig. 1*b* ; this causes condensation of the water vapour in the warm air, forming at first cloud and later drizzle or continuous steady rain. The cloud spreads out ahead of the warm front, and the highest cloud, cirrus or mares' tails, is often about 500 miles ahead. At the rear boundary of the warm sector, known as the " cold front," the cold air is pushing under the warm air forcing the latter to ascend rapidly ; this process is sometimes violent enough to produce squalls. The rapid ascent of the warm air causes the moisture to condense in the form of cumulo-nimbus clouds (shower clouds), from which heavy showers may fall. The cold front gradually overtakes the warm front so that the warm sector is eventually lifted up from the earth's surface. When this has occurred the low is said to be occluded, and the warm and cold fronts have merged into the third type of front known as an " occlusion " (*see* Figs. 2*a* and *b*). When a low has become occluded, it usually decreases in intensity and rate of travel, and gradually fills up. On the other hand, a low which has a marked warm sector is likely to be deepening, the winds associated with it may increase in force and its rate of travel may increase. Lows are usually travelling in a direction approximately parallel to the isobars (and in the direction of the wind) in the warm sector.

The approach of a low is indicated by a falling barometer. In the northern (southern) hemisphere, if the low is approaching from westward and passing northward (southward) of the ship, clouds appear on the western horizon, the wind shifts to a south-westerly (north-westerly) or southerly (northerly) direction and freshens, the cloud layer gradually lowers, and finally drizzle, rain or snow begins. If the low is not occluded, after a period of continuous rain or snow there is a veer (backing) of wind at the warm front, a rise of temperature and diminution or cessation of rain (or snow) in the warm sector, the visibility being usually moderate and the sky overcast with low cloud. The passage of the cold front is marked by the approach from westward of a thick bank of cloud (which however cannot often be seen because of the customary low overcast sky in the warm sector), a further veer (backing) of wind to west or north-west (south-west), sometimes with a sudden squall, rising pressure, a fall of temperature, squally showers of rain, hail or snow, and improved visibility (except during showers). The squally showery weather with a further veer (backing) of wind and drop in temperature may recur while the low recedes owing to the passage of another cold front or occlusion. If the low is occluded, the occlusion is preceded by the cloud of the warm front ; there may be a period of continuous rain mainly in front of and at the line of occlusion, or a shorter period of heavy rain mainly behind the occlusion, according as the air in front of the occlusion is colder or warmer than that behind it. There may be a sudden veer (backing) of wind at the occlusion.

Often another low follows 12 to 24 hours later, in which event the

barometer begins to fall again and the wind backs towards south-west (north-west), or even south (north).

If a low travelling eastward or north-eastward (south-eastward) is passing southward (northward) of the ship, the winds in front of it are easterly and they back (veer) through north-east (south-east) to north (south) or north-west (south-west); changes of direction are not likely to be so sudden as on the southern (northern) side of the low. In the rain area there is often a long period of continuous rain and unpleasant thick weather with low cloud. In winter in the colder regions the weather is cold and raw and precipitation is often in the form of snow.

Near the region of lowest pressure, lulls are sometimes experienced, but sudden changes are likely, and in a deep low the wind may increase in strength very rapidly, perhaps to gale force as the barometer begins to rise.

Sometimes in the air circulation of a large low, usually on the equatorial side and often on a cold front, a secondary depression develops, travelling in the same direction as the primary but usually more rapidly. The secondary often deepens while the original low decreases in intensity. In the region between the primary and the secondary depressions, the winds are not as a rule strong; but on the further side of the secondary, usually the southern (northern) side, winds are likely to be strong and they may reach gale force. Thus the development of a secondary may cause gales at a greater distance from the primary than anticipated, while there may be only light winds where gales were expected.

The above is a brief general description of lows and the associated weather in temperate or middle latitudes of the northern (southern) hemisphere. It must be emphasised, however, that individual lows in different localities differ considerably from one another, according to the characteristics (especially the temperature and humidity) of the air currents of which they are composed, and the nature of the surface over which they are travelling.

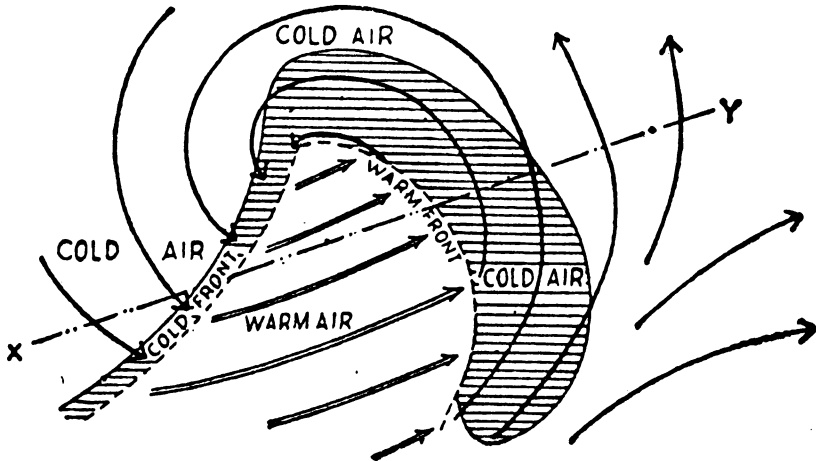
(2) Tropical revolving storms.—*Practical rules for avoiding them.*—These storms are so named because the wind blows round an area in which the lowest pressure is at the centre. The direction of rotation is anti-clockwise in the northern hemisphere and clockwise in the southern hemisphere. The wind does not revolve round the centre of low pressure in concentric circles but has a spiral movement inwards, towards the centre of the storm field.

A tropical storm is not so extensive as the depression of higher latitudes but, within 75 miles or so of the centre, the wind is often far more violent, and the high and confused seas near the centre may cause considerable damage to large and well-found ships, while small vessels (for example, destroyers) have foundered. The danger is still greater when ships are caught in restricted waters without adequate room to manœuvre. Within 5 to 10 miles of the centre the wind is light or moderate and variable, the sky is clear or partially so, and there is a heavy, sometimes mountainous, confused swell; this area is known as the "eye" of the storm. After passing through the relatively windless centre of the storm the wind will suddenly, and with great violence, commence to blow from a direction almost opposite to that experienced on the other side of the windless centre. Due to torrential rain and sheets of almost continuous spray, visibility near the storm centre (but outside the "eye") is almost nil.

Every ship navigating in an area subject to tropical storms during

NORTHERN HEMISPHERE.

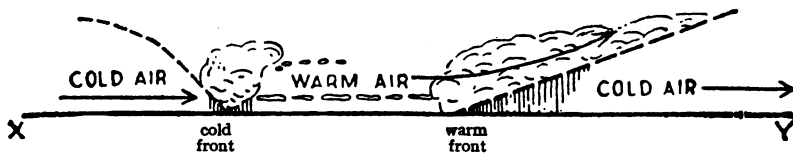
Fig. 1a.



Plan of a developed depression.

The double lines show the flow of the warm air, and the single lines the flow of the cold air.
 The shading shows the areas where rain (or snow) is most probable.
 Width of rain belt ahead of warm front is generally between 100 and 200 miles.

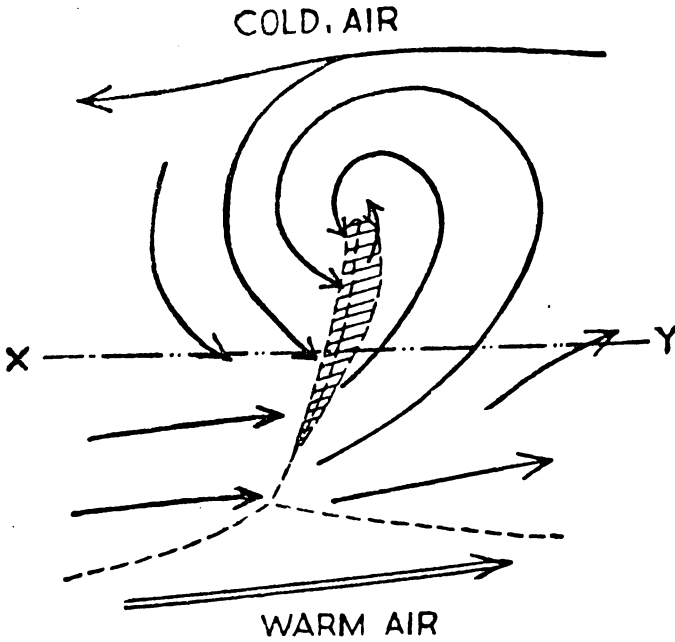
Fig. 1b.



Vertical section of the depression along the line XY.

[See over page.]

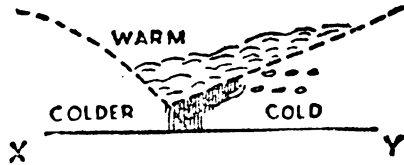
Fig. 2 a.



Plan of an occluded depression.

The shading shows the region where rain (or snow) may be expected near the occlusion.

Fig. 2 b.

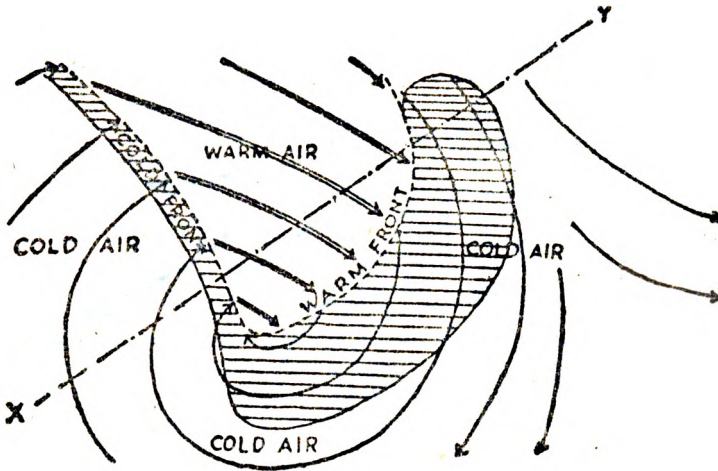


Vertical section of an occlusion of the cold front type.

The air in front of the occlusion is warmer than the air behind it.

SOUTHERN HEMISPHERE.

Fig. 1a.

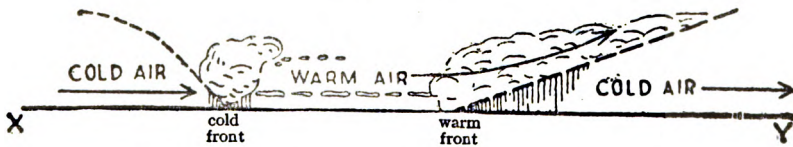


Plan of a developed depression.

The double lines show the flow of the warm air, and the single lines the flow of the cold air. The shading shows the area where rain (or snow) is most probable.

Width of rain belt ahead of warm front is generally between 100 and 200 miles.

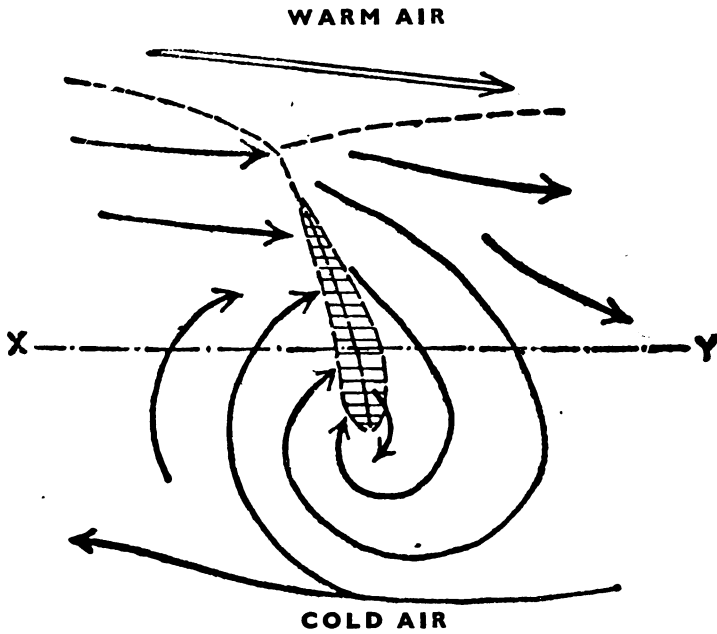
Fig. 1b.



Vertical section of the depression along the line XY.

[See over page.]

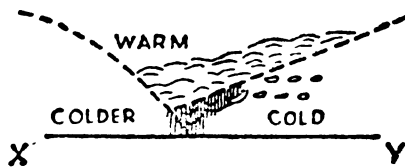
Fig. 2a.



Plan of an occluded depression.

The shading shows where rain (or snow) may be expected near the occlusion .

Fig. 2b.



Vertical section of an occlusion of the cold front type.

The air in front of the occlusion is warmer than the air behind it.

the season of their occurrence should be constantly on the alert for any sign of their approach, so that steps can be taken to avoid the danger zone while there is still time and sea-room.

Localities, season, and average frequency.—Tropical storms occur for the most part on the western side of the oceans, though they are also experienced in the Bay of Bengal, off the north-west coast of Australia, and off the west coast of Central America. They are unknown in the South Atlantic. They are given various names according to the part of the World in which they occur.

Western North Atlantic	}hurricanes	10
Eastern North Pacific		
South Pacific		
Western North Pacific	-typhoons	
Indian Ocean	}cyclones	15
Bay of Bengal		
Arabian Sea		
North-west Australia	-willy-willies	

They are most frequent during the late summer and early autumn of their hemisphere; they are comparatively rare in the southern hemisphere from mid-May to November, and in the northern hemisphere from mid-November to mid-June. In the Arabian Sea, however, storms are most likely to occur at the change of the monsoon, i.e., October–November, and May–June, though they average only one or two a year. Out-of-season storms occur from time to time, particularly in the western North Pacific where no month is entirely safe, and in the Indian Ocean where one is reported south of the Equator perhaps once in two years outside the usual season. The following table shows approximately the average number of severe tropical storms recorded per annum, from statistics taken over several years for the various areas :—

West Indies	5	35
Western North Pacific	25	
„ South Pacific	3	
Southern Indian Ocean	6	
Bay of Bengal	2	
Arabian Sea	1	
Eastern North Pacific	3	
West Coast of Australia	1	

Variations in any one year amounting to 50% above or below the average are not unusual. Some of the figures quoted are probably an underestimate since in the less-frequented parts of the world many storms must escape detection.

Origin, movement and extent.—Tropical storms originate as a general rule in the doldrums, between the parallels of 7° and 15° of latitude; those which affect the western part of the Pacific, South Indian and North Atlantic Oceans are first reported in the western third of those oceans, though there are exceptions such as in the North Atlantic during August and September where an occasional storm is known to begin near the Cape Verde islands. In the northern hemisphere they move off in a direction between 275° and 350°, though most often within 30° of due west. When in a latitude of 25° or so they usually recurve away from the equator and, by the time they have reached the 30th parallel, the track (or path as it is more usually called) is north-easterly. In the southern hemisphere they move off in a WSW.

to SSW. direction (usually the former), recurve at about 15° to 20° S., and thereafter adopt a south-easterly path. In either hemisphere many storms do not recurve but continue in a west-north-westerly (or west-south-westerly) direction until they reach the mainland where they quickly die.

The speed of advance of these storms is usually about 10 knots in their early stages, increasing a little with latitude ; it seldom exceeds 15 knots before recurving, but after recurving 20 to 25 knots is usual though speeds of 40 knots or even more have been known.

Occasionally storms move erratically, the path turning towards the equator, or adopting an easterly component in a low latitude, or even making a complete loop, but on these occasions their speed of advance is low, usually less than 10 knots, while the unusual path is being followed.

The extent of the storm area varies considerably with individual storms but, generally speaking, winds of force 7 or more are improbable at more than 200 miles (especially on the equatorial side of the storm area) and force 8 is unlikely to be exceeded at more than 100 miles, from the storm centre, if in a latitude of less than 20° . Thereafter the radius increases with latitude so that these distances are nearly doubled on reaching the 35th parallel, but the intensity diminishes near the centre. Hurricane force winds are likely within 75 miles of the storm centre in the tropics, and gusts exceeding 150 knots have been reported in a few instances within 50 miles or so (except in the eye of the storm). The aim of the mariner should therefore be to remain as far as possible from the centre of the storm system.

Warning of existence or approach.—In most instances, warning of the position, intensity and probable movement of a storm is given by radio at frequent intervals by meteorological authorities ashore. (See Admiralty List of Radio Signals, Volume III.) Sometimes, however, there is insufficient evidence available for an accurate warning or even a general warning to be given and ships must then be guided by their own observations. Of the following indications of the proximity of a tropical storm, the first is by far the most reliable within 20° or so of the equator ; it should be borne in mind, however, that very little warning may be expected of the approach of an intense storm of unusually small diameter.

(a) If the corrected barometer reading is 3 mb. or more below the mean for the time of year, as shown in a climatic atlas or on the appropriate chartlets in the meteorological text of this Pilot, suspicion should be aroused and action taken to meet any development, such as raising steam in any available additional boilers, &c. It should be noted, however, that the barometer reading must be corrected not only for height, latitude, temperature and index error (if mercurial), or for height and index error if aneroid, but also for diurnal variation, the amount of which is given for each hour of the day in the Air Ministry climatic atlases and in the meteorological text of this Pilot. If the reading thus corrected is 5 mb. or more below normal, it is time to take avoiding action for there can be little doubt that a tropical storm is in the vicinity. According to an analysis of observations in the Western Pacific the centre of the storm is then probably not more than 200 miles away. At this distance, at any rate in the China Sea vicinity, the wind has usually increased to about force 6.

When proceeding through an area liable to be visited by these storms it is desirable to take hourly readings of the barometer.

(b) An appreciable change in the direction and/or strength of the wind.

(c) A swell is sometimes evident, proceeding from a direction that approximates to the bearing of the centre. If ahead of the storm this indication may be apparent before the barometer begins to fall. 5

(d) Extensive cirrus cloud followed, as the storm becomes closer, by much alto-stratus cloud and subsequently fracto-cumulus or "scud."

(e) In addition there is the warning that can be given by Radar. The existence of moderate or heavy rain can usually, under favourable meteorological conditions, be detected at the extreme range of centimetric radar, such as is normally used for navigational purposes afloat, depending on the vertical extent of the rainfall. Subrefraction might decrease and superrefraction increase this range as with any other target. Although moderate or heavy rain does not fall symmetrically all round a storm, it is continuous for at least 50 miles in a broad sector extending from the "eye" of the storm where there is a circular area of relatively light winds and clear or partially clear sky. By the time radar evidence of the exact position of the storm is available, the ship will probably be already in fairly high seas and experiencing winds of force 9 or 10. There should still be time, however, for her to avoid the centre of the storm. 10 15 20

Note.—In accordance with Article 35 of the International Convention for Safety of Life at sea it is the duty of every ship who suspects the presence or formation of a tropical revolving storm immediately to inform other vessels and shore authorities with all the means at her disposal. Weather reports should be made by radio at frequent intervals giving as much information as possible, especially corrected (not for diurnal variation as in (a) above) barometer readings. If barometer readings are uncorrected this fact should be stated in the signal. 25 30

Information required by the seaman before deciding upon action to be taken.—To decide on the best course of action if a storm is suspected to be in the vicinity, the mariner requires to know:—

- (a) the bearing of the centre of the storm; 35
- (b) the semicircle in which the ship is situated;
- (c) the path of the storm.

If an observer faces the wind, the centre of the storm will be from 9 to 11 points on his right-hand side in the northern hemisphere when the storm is about 200 miles away, i.e., when the barometer has fallen about 5 millibars and the wind has increased to force 6 or thereabouts; as a rule the nearer one is to the centre the more nearly does the angular displacement of the wind approach 8 points. A further check on the bearing of the centre may often be obtained by noting the direction from which the swell is coming. The swell travels approximately directly outward from the storm centre. 40 45

The semicircle in which the ship is situated can be determined by taking two such bearings with an interval of from two to three hours between observations, provided that allowance is made for the ship's movement. It can be assumed that the storm is not travelling towards the equator; and, if in a lower latitude than 20°, its path is most unlikely to have an easterly component; and, on the rare occasions when neither of these statements applies, the storm is moving very slowly. (Exceptions to this are most likely in the South Pacific, where occasional storms often move off on a course almost due south developing an easterly component at a latitude of about 15°, and in the western 50 55

North Pacific where some of the out-of-season storms may recur at an early stage.)

In a moving ship associated with a storm progressing at an unknown rate, it is very difficult to estimate from an apparent shift of wind the direction and speed of the storm's motion relative to the ship. The surest method of ascertaining the true shift of wind and thereby finding out in which semicircle the vessel is situated, *is to stop the ship during the period between the two bearings*. If in either hemisphere, these observations show that the wind is veering, the ship is in the right-hand semicircle; if the wind is backing she is in the left-hand semicircle; and if the wind remains steady in direction then the vessel is in the direct path of the storm, which is the most dangerous place of all.

The diagram headed "Typical Paths of Tropical Storms" (at the end of this article) illustrates the terms "dangerous semicircle" and "navigable semicircle." The former lies on the side of the path towards the usual direction of recurvature, i.e., the right-hand semicircle in the northern and the left-hand semicircle in the southern hemisphere. It is so called because a sailing or low-powered vessel caught in it may be blown towards the path along which the storm will pass, or the storm may recurve and the centre pass over her. The navigable semicircle is that which lies on the other side of the path. A ship situated within this semicircle will tend to be blown away from the storm centre, and the recurvature of the storm will increase her distance from the centre.

Practical rules for avoiding tropical storms.—In whatever situation a ship may find herself, the matter of vital importance is to avoid passing within 50 miles or so of the centre of the storm; it is preferable to keep outside a radius of 200 miles or more, because at this distance the wind does not often exceed force 7 (and is generally not more than force 6), and freedom of manœuvre is maintained. If a ship has at least 20 knots at her disposal, and shapes a course that will take her most rapidly away from the storm before the wind has increased above the point at which her movement becomes restricted, it is seldom that she will come to any harm.

Sometimes a tropical storm moves so slowly that a vessel, if ahead of it, can easily outpace it or, if astern of it, can overtake it. Since, however, she is unlikely to feel seriously the effects of a storm so long as the barometer does not fall more than 5 mb. (corrected for diurnal variation) below the normal, it is recommended that frequent readings should be made if the presence of a storm in the vicinity is suspected or known, and that the vessel should continue on her course until the barometer has fallen 5 mb., or the wind has increased to force 6 when the barometer has fallen at least 3 mb. If and when either of these events occurs, she should act as recommended in the following paragraphs, until the barometer has risen above the limit just given, and the wind has decreased below force 6. Should it be certain, however, that the vessel is behind the storm, or in the navigable semicircle, it will evidently be sufficient to alter course away from the centre.

In the northern hemisphere.—(a) If the wind is veering, the ship must be in the dangerous semicircle. A steam or other power-driven vessel should proceed with all available speed with the wind 1 to 4 points (depending upon her speed) on the starboard bow, and should subsequently haul round to starboard as the wind veers, thereby tracing a course relative to the storm as shown by the pecked line in the diagram. If a steamer has insufficient room to make much headway when in the dangerous semicircle she should heave to in the

most comfortable position relative to the wind, preferably with the wind on her starboard bow so that she is heading away from the centre of the storm.

(b) If the wind remains steady in direction, or if it backs, so that the ship seems to be nearly in the path (it is sometimes difficult to determine satisfactorily if indeed the ship is nearly in the path, particularly if in the dangerous semicircle, because the wind does not always behave according to rule) or in the navigable semicircle respectively, a steam vessel should bring the wind well on the starboard quarter and proceed with all available speed, subsequently altering course to port as the wind backs, thus tracing a course relative to the storm as shown by the pecked line in the diagram. 5 10

In the southern hemisphere.—(a) If the wind is backing, the ship must be in the dangerous semicircle. A steam or other power-driven vessel should proceed with all available speed with the wind 1 to 4 points (depending upon her speed) on the port bow, and should subsequently haul round to port as the wind backs, thereby tracing a course relative to the storm, as shown by the pecked line in the diagram. If a steamer has insufficient room to make such headway she should heave-to in the most comfortable position relative to the wind, preferably with the wind on her port bow so that she is heading away from the centre of the storm. 15 20

(b) If the wind remains steady in direction, or if it veers, so that the ship seems to be nearly in the path (it is sometimes difficult to determine satisfactorily if indeed the ship is nearly in the path, particularly if in the dangerous semicircle, because the wind does not always behave according to rule) or in the navigable semicircle respectively, a steam vessel should bring the wind well on the port quarter and proceed with all available speed, subsequently altering course to starboard as the wind veers, thus tracing a course relative to the storm as shown by the pecked line in the diagram. 25 30

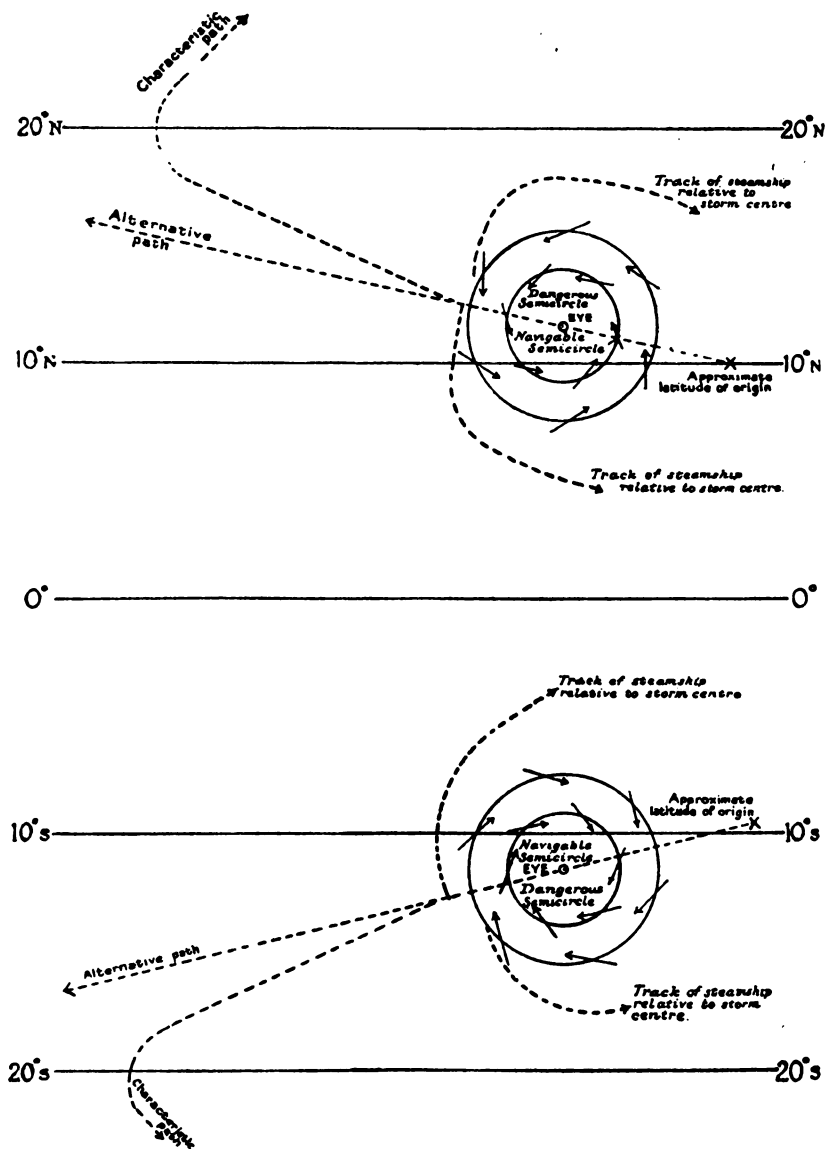
If there is insufficient room to run when in the navigable semicircle, and it is not practicable to seek a safe and effective shelter before the storm begins to be felt, a vessel should heave-to in the most comfortable position relative to the wind and sea, bearing in mind the proximity of land. 35

If a ship finds that she is in the direct path of the storm and has no room to run into the navigable semicircle as directed above, it should be considered, bearing in mind possible recurvature, whether she should endeavour to make her way into the "dangerous" semicircle (where she may at least be better off than remaining in the direct path of the storm) and continue to steam to windward as fast as she can so as to get as far as possible from the centre. 40

If in harbour, or at anchor, a seaman should be just as careful as at sea in watching the shifting of the wind and estimating the movement of the storm relative to himself, so that he may consider shifting his berth with advantage or otherwise act according to circumstances. It is usually preferable, however, to put to sea if this can be done in sufficient time to avoid the worst of the storm. Riding out a tropical storm, the centre of which passes within 50 miles or so, in a harbour or anchorage, even if some shelter is offered, is an extremely unpleasant and hazardous experience, especially if there are other ships in company. Even if berthed alongside, or with special moorings and long bridles in use, a ship cannot feel entirely secure. 45 50

Discretion must, of course, be used. In the case of a low-powered or small vessel with, for example, insufficient warning to enable her to 55

TYPICAL PATHS OF TROPICAL STORMS



Note.—In this diagram the isobars are shown as concentric circles about the eye; in practice this is usually the case within 150 miles or so of the centre. Outside this distance the isobaric form often loses its symmetry and strong winds often extend farther on the polar side than on the equatorial.

gain sufficient distance from the storm by putting out to sea, it will be preferable to remain in a reasonably sheltered harbour. If at sea and warning of an approaching storm is given and there is considered to be insufficient time or sea room to avoid the dangerous part of the storm area, it may be advisable for vessels of this type to seek shelter. In the China Sea, for example, there are so-called typhoon harbours which are listed in the Admiralty Pilot. In all cases, however, the mariner must use seamanship and initiative.

(3) **Local modification of the weather near the coast.**—The information given in Chapter I on climate and weather in the area covered by the Pilot refers necessarily to the coastal and sea regions generally but cannot attempt to deal with the local effects on the wind and weather of each separate headland, bay, or creek. The following notes, however, should prove helpful in showing how the weather in the general vicinity is likely to be modified by the topography or shape of the land close to the actual place in which the mariner is concerned.

- (i) If the coastline is steep-to, onshore winds that approach it at an angle are usually deflected nearly along the shore and increased somewhat in speed. And when the wind approaches a strait whose direction is somewhat similar to that of the wind, the wind tends to blow along the strait and increases in speed as the strait narrows.

When a strong wind blows directly towards a very steep coast, there is usually a narrow belt of contrary gusty winds close to the coast.

- (ii) Similarly when the wind blows onshore towards the entrance to a wide estuary, especially one with hills on both sides, it generally tends to blow up the estuary. This effect is most marked in the afternoon but there is often no such tendency during the night and early morning.
- (iii) An offshore wind is often squally on the lee side of hilly coasts, especially when the air is much colder than the sea, as for example when it blows off snow-covered land and when the wind over the open sea is force 5 or more.
- (iv) Near headlands or islands with steep cliffs there may be large changes in direction (up to about 90°) and speed of the wind in addition to those mentioned above.
- (v) During quiet and warm weather with clear or fairly clear skies, a sea breeze is of common occurrence during the warmer part of the day ; it is especially frequent in the tropics and sub-tropics. It blows onshore from, on the average, 4 to 8 hours after sunrise until shortly before sunset, reaching its maximum development during the afternoon (1300 to 1600) ; if there is an appreciable regional or general wind, then this will be modified by the onshore sea breeze. Under particularly favourable circumstances such as high dry temperatures, relatively cool sea, and hilly background to coast, the sea breeze may blow as much as force 4 (occasionally 5) and extend 20 miles or more to seaward from the shore. At night under similar circumstances a lighter breeze blows from the land to the sea ; it seldom extends more than 5 miles from the shore nor does it become appreciable much before 2200 local time ; under favourable conditions, as in the tropics, it usually lasts until an hour or so after sunrise.
- (vi) When sea fog that is caused by the passage of warm air over a

colder sea surface is general over the open sea, visibility is better close to leeward of a hilly island or promontory than to windward. This effect is most marked in late spring and summer, during the early afternoon when the land is at its warmest, and then applies to low-lying land as well.

- (vii) Radiation fog which forms over land on quiet nights with clear skies, mainly in autumn and winter, and sometimes spreads a few miles out to sea, is least thick during the afternoon and is often worst during the first hour or two after sunrise.

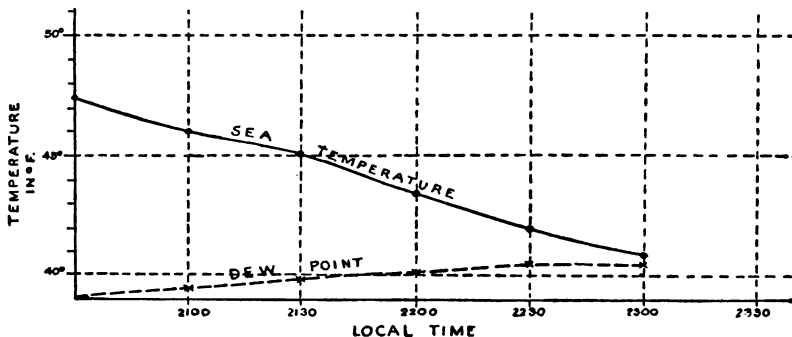
(4) **Forecasting sea fog.**—The most frequent type of fog in the open sea is that caused by relatively warm air flowing over a colder sea. Warning of this type of fog may be obtained by frequent observations of air and sea surface temperatures; if the sea temperature falls below the dewpoint of the air, fog is almost a certainty. The following procedure is recommended whenever the temperature of the air is higher than, or about equal to, that of the sea, especially at night when approaching fog cannot be seen until shortly before entering it.

Sea and air (both dry and wet bulb) temperatures should be observed at intervals of about 5 miles and the sea temperature plotted against dewpoint. The dewpoint is obtainable from tables published in various text-books, but at temperatures up to about 60° F. a close enough approximation may be obtained by assuming it to be the same amount below the wet-bulb temperature as the latter is below the dry-bulb temperature; for example, if the dry bulb reads 50° F. and the wet bulb 48°, the dewpoint is about 46°. If the curves of sea temperature and dewpoint converge, fog may be expected by the time at which they coincide.

The figure below represents conditions that might be found by a low-powered ship in about long. 40° W. proceeding westward on the appropriate lane route for Halifax, Nova Scotia. At 2200 it would become evident that there is a probability of running into fog in about an hour's time, assuming that the sea temperature continues to fall at about the same rate that it has done during the last 1½ hours.

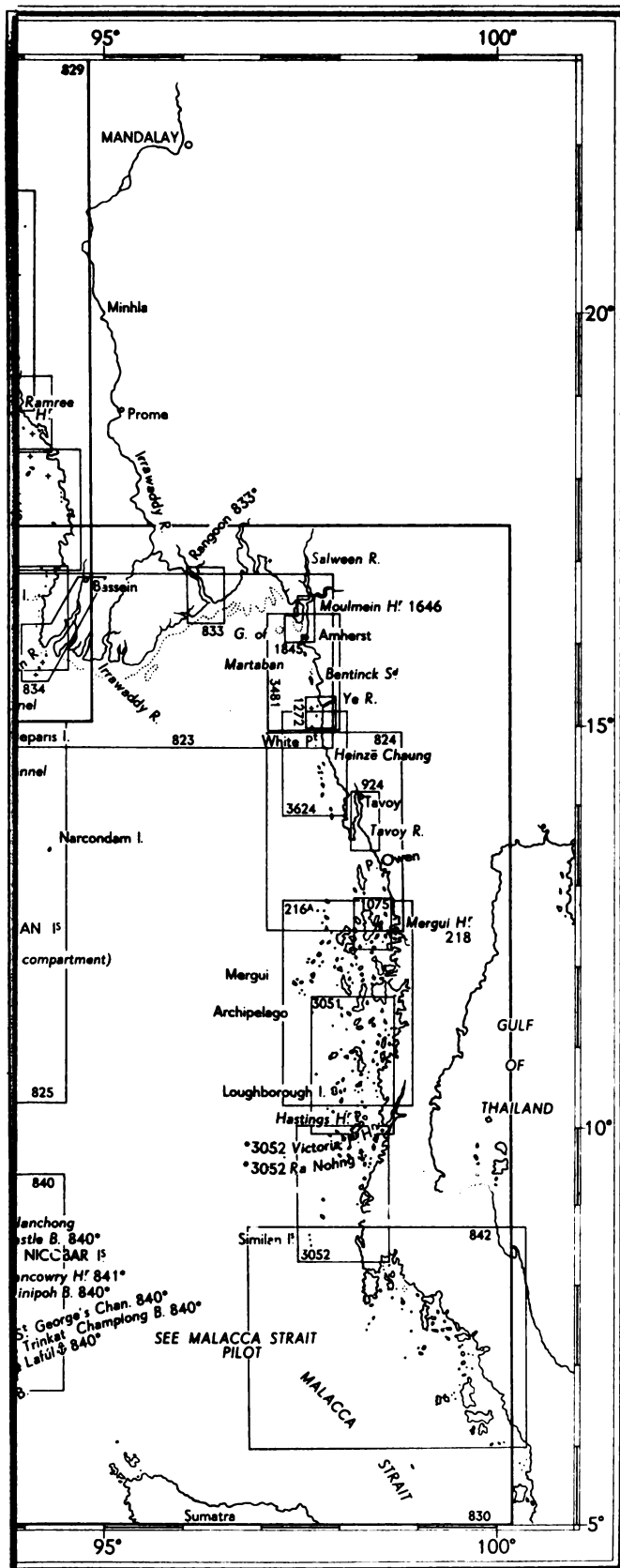
From the appropriate chart of average sea surface temperatures it can be seen where a rapid fall of temperature may be expected, so that if the dewpoint is within 5° or so of the sea temperature when approaching the colder water zone, this will also give a fairly reliable warning of fog.

If it is desirable and practicable to escape from fog, a ship should steer for warmer water which will again be evident from the charted isotherms.



Fog, or very poor visibility, at sea may also occur in snow or heavy rain, or in association with the passage of a warm front or occlusion, or, when within 20 miles or so of land, it may occur as a result of radiation fog extending from the land; in high latitudes in winter, sea smoke may be met near land, when very cold offshore winds are blowing, or near extensive ice. The method described above will not give warning of these fogs, of which frontal fogs, though common in middle latitudes, are neither so extensive nor so persistent in any one locality, and the other fogs mentioned are rarely encountered far from land (or extensive ice).

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IMPORTANT.

Details of Lights, Fog Signals, and Time Signals (visual) are not included in this volume; for this information the Admiralty List of Lights, Vol. 6, should be consulted.

Information regarding Vertical Movement of the Water is not included; for this the Admiralty Tide Tables should be consulted.

Details of Radio information (weather bulletins, storm and navigational warnings, time signals, fog signals, and D.F. stations) are not included; for this information the Admiralty List of Radio Signals should be consulted.

APPENDIX

Results of 1911, 1912, 1913, and 1914 are given in this appendix. The results of 1915 are not included in this appendix, but are given in the main text of the report.

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BAY OF BENGAL PILOT

CHAPTER I

GENERAL REMARKS — CEYLON — INDIA — PAKISTAN — BURMA — THAILAND — FRENCH POSSESSIONS — ISLANDS IN THE BAY OF BENGAL — CURRENTS — TIDES — THE BORE — SIGNALS — BUOYAGE SYSTEMS — LIFE-SAVING — STANDARD AND SUMMER TIMES — AIR LIGHTS — COMMUNICATIONS — FUEL — REPAIRS — SUBMARINE CABLES — REGULATIONS — BRITISH CONSULAR OFFICERS — MUD VOLCANOES — CLIMATE AND WEATHER—CLIMATIC TABLES

Chart 70.

GENERAL REMARKS.—The Bay of Bengal is comprised between the parallels of 8° and 20° N. latitude, and the meridians of 80° and 98° E. longitude.

The shores of the bay are bordered by the following territories :—
On the west by the Dominion of Ceylon and the Republic of India, including the small French colonies of Karikal and Pondichéry ; at the head, by East Pakistan, part of the Dominion of Pakistan ; and on the east by the Republic of Burma and by part of the kingdom of Thailand.

Chart 828.

CEYLON.—Ceylon is an important island lying off the south-eastern part of the Indian peninsula, its north-western coast being almost connected to the peninsula by the narrow line of islands and shoals which form the head of the Gulf of Mannar.

Physical features.—The central part of the southern half of the island is mountainous and, on a clear day, its outline is visible from the western seaboard. Pidurutalagala, 8,296 feet (2,528^m6) high, is not distinguishable from the sea. The remarkable cone known as Adam's peak 7,353 feet (2,241^m2) high, is very prominent from west-ward and southward during the North-east monsoon.

With the exception of several isolated hills, rising abruptly from the eastern plain, the remainder of the island is practically flat, and is known as the Low country, which occupies the entire northern half of the whole area, as well as the wide coastal plain from which the mountain district takes its rise.

On the western side of the mountain district the foothills lie compactly together in long parallel folds, but in the eastern part the

Chart 828.

mountains terminate somewhat abruptly at the summit of Namunakuli, enclosing a crater-like area of open grass land, known as the Patana, in the centre of which, at an elevation of about 4,000 feet (1,219^m2),
 5 are the naval and military camps of Diyatalāwa.

The western and southern coasts, and many parts of the less populated eastern coast, are planted more or less densely with coconut trees; these trees are also found in the vicinity of every village in the island, at which the temperature is suitable to their growth.

10 One of the peculiarities of the coastal parts is the extensive fresh and salt-water lagoons, lying a short distance inland. Lagoons exist on both the eastern and western coasts, and notably at the northern extremity of the island, but only to a limited extent at the southern end. They appear to have been formed by the action of the currents
 15 off the coast, combined with that of the monsoon swell, in piling up a sand ridge, thus enclosing a space, originally of sea water. These lagoons may now be seen in process of formation in the northern part, but in the southern part they are complete, and lie some distance inland, the water in them having become fresh from the heavy rainfall
 20 usual in Ceylon.

Slight earthquake shocks are occasionally felt in Ceylon, but they are not sufficiently intense to cause serious damage.

Charts 813, 828.

Rivers.—The island, in the parts adjacent to the mountains, is
 25 well watered, but in the northern Low country less permanently so. The rivers of the western side, fed by the longer-continuing rains of the South-west monsoon, are never without water, but those running northward, dependent on the shorter rainy season of the North-east monsoon, are reduced at other times of the year to dry,
 30 sandy river beds, with a few pools.

None of the rivers are of great length, nor are they navigable to any appreciable extent, except by native boats, and all have bars and lagoons at their mouths. The following are the principal ones:—
 Mahaweli ganga, rising near the centre of the island and entering
 35 the sea at Koddiiyar bay, Trincomalee, 206 miles in length, is the longest; others are Kālu ganga and Gin ganga, between Colombo and Galle harbour; Walawe ganga and Kirindi oya, entering the sea through the south coast.

Chart 828.

40 **Population.**—The population of Ceylon comprises various races, notably the Sinhalese, Tamils, Arabs, Eurasians and Veddas.

At the end of 1950 the estimated population was about 7,500,000, of whom about 5,400 were Europeans.

Government.—After passing through various stages of self-
 45 government Ceylon attained full membership of the British Commonwealth of Nations on 4th February, 1948.

The executive power of the island, which is vested in Her Majesty, is exercised by a Governor-General. A Prime Minister and Cabinet are collectively responsible to the Parliament for the general direction
 50 and control of the government. The Parliament consists of Her Majesty, a Senate and a House of Representatives.

The island, which has an area of 25,332 square miles, is divided for administrative purposes into 9 Provinces (sub-divided into 19 Districts), each in charge of a Government Agent who is a member of the
 55 Ceylon Civil Service.

Trade.—Shipping.—The principal exports are coconuts, tea,

Chart 828.

rubber, coconut oil, copra and cinnamon. The chief imports are rice and paddy, cotton manufactures, sugar, manures, coal and coke.

In 1950, 2,635 vessels of a total tonnage of 11,461,131, entered and cleared the port of Colombo.

Communications.—There is regular communication by steamer between Colombo and all parts of the world.

The railways of Ceylon are all owned and worked by the Government. The principal towns on the coast are connected to the railway system, and most of the towns and larger villages are connected to the telegraph and telephone systems.

Ports.—There are three chief ports in Ceylon, namely the artificial harbour of Colombo, on the west coast, available for all classes of vessels; Galle, an open bay at the south-western bend of the coast; and the fine natural harbour of Trincomalee, on the north-east coast, the last-named being the only naturally-protected harbour available for all classes of vessels.

Weights and measures.—The standard weights and measures used in Ceylon are the same as those of Great Britain. In conjunction with these many local weights and measures are used.

Currency.—The monetary unit is the Ceylon rupee, which was devalued with sterling in September 1949. The buying rate between Ceylon and the United Kingdom is 1s. 6d., and the selling rate, 1s. 5d., per rupee.

Currency notes of the values of one rupee, 2, 5, 10, 50 and 100 rupees, also subsidiary currency notes for 50 and 25 cents, are in circulation.

The following subsidiary coins were legal tender on 31st December, 1951 :—

Nickel brass.—50, 25, 10 and 2 cents.

Cupro-nickel and nickel brass.—5 cents.

Copper and bronze.—One cent.

Copper.— $\frac{1}{2}$ cent.

Climate.—The heat in the Low country of Ceylon is less oppressive than in India. There is often a refreshing breeze, particularly near the coast. The climate of Colombo is so largely tempered by sea breezes that it is one of the healthiest places in the tropics in which to reside. Parts of Ceylon are malarious, but the south-western part of the island is comparatively free from this scourge. See Climatic tables for Colombo and Trincomalee, pages 70 and 71.

Chart 748b.

THE INDIAN SUB-CONTINENT.—The peninsula forming the sub-continent, with its northern base resting on the Himalayan ranges, and bordered on the north-western side by the Sulaiman range and the hills of Baluchistan, stretches southward into the Indian ocean, Cape Comorin being its southern extremity. It is separated from the island of Ceylon by Palk strait and the Gulf of Mannar. The major part of its eastern coast is washed by the Bay of Bengal and its western coast by the Arabian sea.

The sub-continent is divided politically into the Republic of India and the Dominion of Pakistan, the latter being in two parts, known as West and East Pakistan which are separated by more than a thousand miles of Indian territory. The boundary on the east coast of the sub-continent between the Republic of India and East Pakistan is the mouth of Hāriābhāṅgā river (*Lat.* 21° 40' N., *Long.* 89° 08' E.).

Chart 70.

REPUBLIC OF INDIA.—The seaboard coast of that part of the republic which is washed by the Bay of Bengal, is divided administratively between the Indian states of Madras, Orissa and West Bengal.

- 5 **Government.**—The new Constitution of India, which came into force on 26th January, 1950, declared that India was a sovereign democratic republic, but remained a member of the Commonwealth. The capital and seat of Government is New Delhi.

Communications.—The principal towns on the coast are connected
10 with the general railway system and all the important towns and villages are connected with the general telegraph and telephone systems.

Weights and measures.—The following weights and measures are applicable generally to the whole of the Indian peninsula :—

The standard maund of 40 seers = 82 lb. 4 oz. 9 dr. avoirdupois.

- 15 The standard tola = 180 gr. troy.

The standard seer of 80 tolas = 2·057 lbs.

The standard pound (7,000 standard grains), ounce, cwt. and ton are also standard weights side by side with the above.

- Currency.**—Closely following the devaluation of sterling in 1949,
20 the currency of the Republic of India was devalued to the same extent. The following standards are given as a guide.

The monetary unit is the Indian rupee, which equals 1s. 6d.

One lakh = 100,000 rupees and is written thus :—Rs. 1,00,000.

- A lakh of rupees, when the rupee is 1s. 6d., is equivalent to
25 £7,500.

One crore = 10,000,000 rupees and is written thus :—Rs. 1,00,00,000.

The subsidiary coins are :—

Silver.—One rupee.

- 30 Nickel.—One rupee, $\frac{1}{2}$ rupee, or 8-anna piece, 4, 2, 1, and $\frac{1}{2}$ anna pieces.

Bronze.—One pice or $\frac{1}{4}$ anna, $\frac{1}{2}$ pice or $\frac{1}{8}$ anna, one pie or $\frac{1}{16}$ anna pieces.

3 pie = 1 pice.

- 35 4 pice = 1 anna.

16 annas = 1 rupee.

Notes of the values of 2, 5, 10, 50 and 100 rupees are in circulation.

In 1940, there was introduced a special issue of one-rupee notes, each of which is, for all purposes, equal to a silver rupee.

- 40 In 1940, there was introduced a special issue of one-rupee notes, each of which is, for all purposes, equal to a silver rupee.

Chart 828.

- STATE OF MADRAS.**—**General remarks.**—Madras state occupies the whole of the southern part of the Indian sub-continent,
45 with the exception of the small French settlements of Pondichéry, Karikal, Mahé and Yanam, and has an area of 127,768 square miles. In 1951, the population was 56,952,332.

- The state has a coastline of about 1,700 miles but that part on the western shore of the Bay of Bengal, which is included in this volume,
50 extends from Pamban pass as far northward as the junction with Orissa state in about lat. 19° N., and, northward of Point Calimere, is known as the Coromandel coast. There are 25 districts in the state, excluding Madras city.

- The state administration is vested in a Governor assisted by a
55 Council of Ministers with the Chief Minister at the head. The two

Chart 828.

Houses of the Legislature, the Legislative Council and the Legislative Assembly, are elected on the basis of the Government of India Act, 1935.

The seat of Government is at Madras city which, in 1951, had a population of 1,416,056. 5

Physical features.—A plateau, varying in elevation from 1,000 to 3,000 feet (304^m8 to 914^m4), occupies the central area of the state; it is flanked on either side by ranges known as the Western and Eastern Ghāts. 10

The Western Ghāts, which extend the whole length of the western coast, at distances of from 20 to 100 miles inland, are from 3,000 to 8,000 feet (914^m4 to 2,438^m4) high; the Eastern Ghāts, a less marked formation, about 2,000 feet (609^m6) high, back the eastern coast; between these latter and the Bay of Bengal is a broad strip of land. 15

Nearly the whole trend of the drainage is from west to east, into the Bay of Bengal, the three principal rivers being the Godāvari, the Kistna, and the Cauveri, all three rising on the western side of the peninsula, and forcing passages for themselves through the Eastern Ghāts; the Godāvari and the Kistna have each a course of more than 800 miles. 20

Production.—Industry.—Agriculture engages about 71 per cent. of the population. The principal industry, other than agriculture, is cotton. There is a Government quinine factory, at which 630,767 lbs. of chincona bark were treated in 1948-49. There are large irrigation works, and there is a considerable output of timber. 25

Ports.—There is no good natural harbour in that portion of the Madras coast described in this volume, though Cocanāda affords partial shelter. The artificial harbour of Madras and the harbour at Vizagapatam are available for vessels of deep draught.

Trade.—Shipping.—The principal exports are ground-nuts, tea, 30 cotton piece goods, hides and skins, cotton twist yarn, tobacco, spices, cotton, rice and rubber; the chief imports are machinery, oils, metals, vehicles, cotton manufactures, instruments and manure.

Ramnad.—Ramnad, a district of the state of Madras on the northern shore of the Gulf of Mannar, is the most southerly portion of the 35 Indian sub-continent, the coast of which is described in this volume. Ramnad district lies approximately between the parallels of 9° and 10° N., and between the meridians of 78½° and 79° E. In 1931, the population was 1,838,955.

Ports.—The ports are Tondi and Devipattanam in Palk strait, 40 Kilakari in the Gulf of Mannar, and Pamban and Dhanushkodi, which may be said to be in the waters of both.

Rivers.—The principal river is the Vaigai, which flows into Palk strait, but it is more of a drainage channel than a permanent river.

Tanjore.—The district of Tanjore lies northward of Ramnad 45 district, between the parallels of 9° 51' and 11° 25' N., and the meridians of 78° 47' and 79° 52' E. It is bounded on the north by Coleroon river, which separates it from the districts of Trichinopoly and South Arcot. Its seaboard consists of two sections, one bordering Palk strait for 68 miles, from the Ramnad boundary to Point Calimere; the other 50 from Point Calimere to Coleroon river, a distance of 72 miles; the small French territory of Karikal is situated about the middle of the latter section.

The population, in 1931, was 2,385,920.

Physical features.—The northern and eastern portions of Tanjore 55 form the delta of the Cauveri river, which, with its numerous branches,

Chart 828.

intersects and irrigates more than half the district, and this is the most densely populated area. It is a level alluvial plain, covered almost without a break by rice fields; it slopes gently towards the sea, with the villages half-hidden by coconut palms, and is devoid of forests, with no eminences, except ridges and dunes of blown sand which fringe the coast. The non-deltaic part of the district, about 50 feet (15^m2) higher, is likewise an open plain, sloping eastward and destitute of hills.

- 10 The Cauveri river rises in the Western Ghāts and flows south-eastward across the plateau of Mysore, entering the state of Madras over the falls of Sivasamudram; at Trichinopoly the river divides into two channels at the famous Trichinopoly rock; the northern channel, which is named the Coleroon river, is navigable by small craft for a few miles from its mouth.

Ports.—The principal port is Negapatam, and among the more important of the other ports are Adirampatnam and Tirumullaivasāl.

- Health.*—Although the delta is hot and relaxing, the climate is generally healthy, and the increased breadth of the irrigated land, as the delta widens, causes more rapid evaporation of the water with which it is covered, rendering that part cooler than the sea. A swamp westward of Point Calimere, causes a great exception to the general healthiness, and this district is said to be malarious from April to June.

Karikāl.—See page 20.

- 25 *South Arcot.*—The district of South Arcot lies between the parallels of 11° 11' and 12° 15' N., and the meridians of 78° 38' and 80° 00' E.; it is bounded on its northern side by the districts of North Arcot and Chingleput. Within it lies the French territory of Pondichéry.

The population, in 1931, was 2,454,507.

- 30 *Physical features.*—On the western side the Kalrayan hills, from 3,000 to 4,000 feet (914^m4 to 1,219^m2) high, are connected with the Shevaroy hills, and farther northward is part of the Javadi hills; in the western and north-western parts are some rocky hills appearing in isolated groups, the most remarkable being Tiruvannamalai, a peak 2,668 feet (813^m2) high, with long sloping sides mostly covered with jungle. The remainder of the district is a flat plain, with a few sand ridges near the coast.

- The rivers all flow from west to east. The Vellar, which for a portion of its course forms the boundary between the districts of South Arcot and Trichinopoly, flows between high banks and is tidal for 7 or 8 miles from its mouth, being navigable by small boats for that distance. Farther northward the Paravanār, the principal river running through the district, flows through low banks over a sandy bed; it has no tributaries of any consequence. Southward of the Paravanār and connected to it by a natural channel, named the Malattar, is the Gadilam; and northward is the Gingee river, which enters the sea near Pondichéry.

Ports.—Porto Novo and Cuddalore are the only ports; both are open roadsteads.

- 50 *Health.*—The climate of the district is fairly dry and generally healthy, but malaria is endemic in some parts, epidemic cholera is frequent and elephantiasis is met with at some places along the coast.

Pondichéry.—See page 20.

- 55 *Chingleput.*—The district of Chingleput lies between the parallels of 12° 15' and 13° 47' N., and the meridians of 79° 34' and 80° 21' E.;

Chart 828.

it is bounded on the north by Nellore district, and contains within its limits the city of Madras.

The population, in 1931, was 1,655,115.

Physical features.—Near the sea the district is flat and dreary, 5 but elsewhere it is undulating and in some places even hilly. In the extreme north are the Nagari (Pulicat) hills, in which range is the well-known Kambakkam Drug, 2,548 feet (776^m6) high.

The rivers all flow from west to east, the most important being the Palar and the Cooum. 10

The Buckingham canal runs along the whole coast of Chingleput and utilises the backwaters with which the whole coast is fringed; it gives direct communication with South Arcot southward and with the Godāvari northward.

Port.—Madras is the only harbour in the district. 15

Health.—Although fever is endemic in some places in the west, and leprosy and elephantiasis in the east, it is generally healthy.

Nellore.—Nellore district is bounded on the north by the Guntur district; it lies between the parallels of 13° 29' and 16° 01' N., and the meridians of 79° 05' and 80° 16' E. 20

The population, in 1931, was 1,486,222.

Physical features.—The country rises very gradually to the Eastern Ghāts, on the west, and the scenery is uninteresting, being generally wide extents of scrub jungle, but fine groves are occasionally met with in the vicinity of villages and tanks, and stretches of bright 25 green rice in places.

Of the backwaters, which separate the district from the sea, Pulicat lake is the best known; the Kistnapatam backwater has a depth of over 30 feet (9^m1) in the hot season, but a bar, over which there are depths of only 5 or 6 feet (1^m5 or 1^m8), blocks the entrance. 30

The principal rivers are the Swarnamukhi, the Upputeru, Penner, Manneru, and Paleru. Of these, the Penner, on which is the town of Nellore, is the most important, but none are navigable except the Upputeru, which is navigable by boats with a draught of 2 or 3 feet (0^m6 or 0^m9) for about 25 miles from its mouth. 35

Ports.—There are no ports with any seaborne trade. The Buckingham canal is the only navigable waterway.

Health.—The climate is dry and fairly healthy, being subject to no sudden changes of temperature, but for two or three months of the year, when the westerly wind blows, the heat is excessive; owing to 40 the sea breeze, that tract of country near the sea is generally cooler than inland.

Guntur district.—The Guntur district, was formed, for administrative purposes, in 1904, and extends to the western bank of the Kistna river, having an area of 5,757 square miles, and a coastline of 45 about 66 miles; the only river of any importance is the Kistna.

In 1931, the population was 2,035,660.

Port.—Nizampatan is the only port.

Kistna.—The Kistna district, the next district to Guntur, on the north, is bounded on its north-eastern side by the district of Godāvari, 50 and lies between the parallels of 15° 43' and 17° 09' N., and the meridians of 79° 14' and 81° 33' E.

The population, in 1931, was 1,254,208.

Physical features.—The extreme west of the district consists of stony uplands, with rocky hills or low ranges, the central and northern 55 portions are a level plain of black cotton soil, but the eastern part

Chart 828.

consists of two distinct divisions. The main delta area of the Kistna river, an almost flat expanse, is covered with irrigated rice fields and contains some of the most fertile land in the state. The coast
5 is fringed with a belt of blown sand, sometimes extending inland for several miles, and with dunes from 30 to 50 feet (9^m1 to 15^m2) high. The island of Divi is separated from the main portion by the Puligadda arm of the Kistna river.

The only hills, which are outliers of the Eastern Ghāts, are on the
10 western side, and Colair lake lies within the district.

The Kistna river, the only one in the district, rises in the Western Ghāts, about 40 miles from the Arabian sea, and has a total length of 800 miles, being one of the largest rivers in the southern part of the sub-continent. From the Eastern Ghāts it flows for 100 miles between
15 the Kistna and Guntur districts.

Colair lake, the only large natural fresh-water lake in the Madras state, is a large, shallow depression, half lake, half swamp, situated about 17 miles inland; its extent varies greatly, as, during the South-west monsoon it exceeds 100 square miles, while in the dry season it
20 shrinks considerably, and even sometimes dries up altogether. It has two outlets, the Perantala Kanama and Juvir Kanama, and passes into the tidal stream of the Upputeru, and thence to the sea.

Port.—Masulipatam is the only port.

Health.—The climate, although trying on account of the great heat,
25 is fairly healthy, and fever is, on the whole, uncommon.

Charts 828, 829.

Godāvāri.—The district of Godāvāri is bounded on its north-eastern side by the district of Vizagapatam. It lies between the parallels of 16° 19' and 18° 04' N., and the meridians of 80° 52' and
30 82° 36' E.

The French possession of Yanām or Yanáon, without any seaboard, lies within this district.

The population, in 1931, was 1,920,582.

Physical features.—The north-western angle of the district is almost
35 entirely occupied by a portion of the range of the Eastern Ghāts, consisting of scattered hills and spurs, the highest peak of which is 4,478 feet (1,364^m9) high. The Godāvāri river, the only river of any consequence in the district, and from which the district takes its name, runs directly through the centre of the district. At Dowlai-
40 weram, 40 miles in a straight line from the sea, the river divides, forming the Vasishta Godāvāri on the west, and the Gautami Godāvāri on the east, and flows through a wide delta to the sea.

At Dowlaihwaram is a masonry dam 2½ miles in length, below which three separate canal systems branch off. The river is navigable
45 for small boats, throughout the district, and above the dam several Government steam vessels are employed.

Port.—The only port with any trade is Cocanāda.

Health.—The district is generally healthy, but fever is very prevalent, especially during the cold season, and this is particularly the
50 case in the agency tracts, where it is of a virulent type in some parts; beri-beri is common along the coast.

Chart 829.

Vizagapatam.—The district of Vizagapatam is bounded on its north-eastern side by the district of Ganjām. It lies between the
55 parallels of 17° 15' and 20° 07' N., and the meridians of 81° 24' and 84° 03' E.

Chart 829.

The population, in 1931, was 3,607,948.

Physical features.—The district is for the most part hilly and picturesque, especially in the north, but in the south there is a cultivated plain, divided from the hilly part by a portion of the Eastern Ghāts, which, passing from south-west to north-east through the district at an average elevation of from 2,000 to 3,000 feet (609^m6 to 914^m4), forms the main watershed. 5

The rivers of the district group themselves into two sets; namely, those which flow eastward through the coastal plain into the sea, and those which drain the Ghāts, and the country westward of them, and flow westward into the basin of the Godāvāri. None of the rivers are of any importance for navigation. 10

Ports.—The principal ports are Vizagapatam and Bimlipatam.

Health.—The climate is moist and relaxing along the coast, hotter and drier inland, and wettest and coldest in the hills; the most prevalent disease is malarial fever, which differs in intensity according to the locality, being of a comparatively mild type on the plains; beri-beri and elephantiasis are common chiefly on the coast. The climate is pleasant in the cold season, although somewhat relaxing at other times. 15 20

Ganjām.—Ganjām is the northernmost district of the Madras state; it lies between the parallels of 18° 12' and 20° 26' N., and the meridians of 83° 30' and 85° 12' E.

The population, in 1931, was 2,411,619. 25

Physical features.—A considerable portion of the district is mountainous and rocky, but it is interspersed with valleys and fertile plains, with pleasant groves of trees, which, with its background of wild hills often covered with dark jungle, renders it one of the most beautiful districts in the state. 30

The Eastern Ghāts traverse it from south to north, and are nowhere more than 50 miles from the sea, being only 15 miles at Baruva, in the centre of the district, and here Singarazu and Mahendragiri peaks, the two loftiest in the district, are nearly 5,000 feet (1,524^m0) high: Deodongar, 4,535 feet (1,382^m3) high, the next highest hill, lies westward of Mahendragiri. 35

The three principal rivers, which are all used for irrigation, are the Lāngulya, the Vamsadhāra and the Rushikulya. The Lāngulya for the last 30 miles of its course forms the southern boundary of the district; it is crossed by the trunk road, over a fine bridge, at Chicacole, 3 miles from the sea. The Vamsadhāra discharges at Kalingapatam and the Rushikulya, which drains the northern part of the district, at Ganjām. 40

Ports.—The ports are Kalingapatam, Baruva and Gopālpur.

Health.—With the exception of the town of Ganjām, which is exceedingly malarious, the climate on the coast is usually cool and healthy, and the district is one of the few in the state which enjoys a cool season. 45

ORISSA STATE.—General remarks.—Orissa was constituted a separate state on 1st April, 1936, by the Government of India Order, 1936. The new state is the result of the amalgamation of various Oriya-speaking peoples who had previously belonged to Madras, Bihar and Orissa, and Madhya Pradesh. The state comprises 13 districts with a total area of 59,869 square miles and, in 1951, had a population of 14,644,293. 55

Chart 829.

The administration is vested in a Governor assisted by a Council of Ministers and by a Legislative Assembly. For purposes of jurisdiction, the state is divided into two Commissioners' divisions. The 5 headquarters of the Government are at Cuttack which is the state capital, but in 1952 a new capital was under construction at the historic town of Bhubaneswar, about 16 miles from Cuttack.

Trade.—Shipping.—Agriculture engages 90 per cent. of the population, the principal crop being rice, which covers nearly half the 10 cropped area. Other important crops are sugar-cane, jute, wheat, tobacco and betel.

The minerals of the province include iron, coal and mica. There are large iron and steel works at Jamshedpur.

In 1937-38, 55 steam vessels of 123,041 tons entered the ports of Orissa. 15 **Puri.**—This district lies between the parallels of 19° 28' and 20° 26' N., and the meridians of 84° 56' and 86° 25' E.; it joins Ganjām on the west, and is bounded on the east by Cuttack district.

The population, in 1931, was 1,035,154.

Physical features.—The district may be divided into three tracts, 20 viz.:—the western, central, and eastern. In the first is Chilka lake, about 35 miles in length, and on its northern side are spurs from the hills farther northward, extending to its shore, with fertile valleys between them. The middle and eastern tracts consist entirely of alluvial plains, watered by a network of channels.

25 The coastline is a belt of sandy ridges, varying from a few hundred yards to about 4 miles in breadth, and in the eastern part is Sar lake, a backwater of the Bhārgāvi river.

The Nun, Dayā and Bhārgāvi rivers, which all flow into Chilka lake, are mostly shallow in the dry season, but are much swollen 30 during the rains; the Kushbhadra, the only river which flows into the sea, is of little value for navigation.

Port.—Puri is the only port.

Health.—Cholera is often imported by pilgrims; fever is prevalent during the cold season, and small-pox occasionally appears in a virulent 35 form.

Cuttack.—The district of Cuttack lies between the parallels of 20° 02' and 21° 10' N., and the meridians of 85° 20' and 87° 01' E.

The population, in 1931, was 2,176,707.

Physical features.—The district consists of three distinct tracts; 40 that along the coast is a marshy jungle-covered strip, from 3 to 30 miles in width, intersected by innumerable streams and creeks; behind this is an arable tract of rice-land intersected by large rivers which flow from the western mountains; and behind this again, is a broken hilly region along the western boundary. A few isolated hills stand in the 45 plains, the chief being Assia, 2,500 feet (762^m) high, and the highest point in the district, Udayagiri, on which is a colossal image of Buddha, and Naltigiri.

The rivers, which form a conspicuous feature of the district, include the Mahānadi, the Brāhmanī and the Baitaranī; these rivers enter 50 the sea through a wide delta which embraces the whole coastline of the district. The Mahānadi divides near Cuttack, about 50 miles in a straight line from the sea, into two principal channels, the Devi southward and the Mahānadi northward, with many offshoots. The Brāhmanī and the Baitaranī meet and flow into the sea at Palmyras 55 point as the Dhāmra; the Kharsua is an important tributary of the Brahmanī.

Chart 829.

Balasore.—Balasore is the northern district of the state of Orissa, and lies between the parallels of 20° 44' and 20° 51' N., and the meridians of 86° 16' and 87° 31' E.

The population, in 1931, was 990,600. 5

Physical features.—The district consists of a strip of alluvial land lying between the sea and the hills which rise from the western boundary.

The Baitarani, which forms the boundary between Balasore and Cuttack, and which, after its junction with the Brāhmanī, is named the Dhāmra, is navigable as far as Olokh, about 15 miles from its mouth, after which it is no longer tidal and can be forded in the hot weather. Other rivers are the Kansbans, which is subject to sudden freshets and flows out by two mouths, the southern named Gamai; the Burhābalang, on which is the town of Balasore; the Pānchpāra; and the Subarnarekha. 10 15

Ports.—The ports are Chāndbāli and Balasore.

Health.—The district suffers from severe epidemics of cholera and it is liable to small pox; elephantiasis is extremely common, and fever prevails in the cold season, but the country is singularly free from malaria, except in one part. 20

WEST BENGAL STATE.—General remarks.—The state of West Bengal which was established under the terms of the Indian Independence Act, 1947, consists of part of the former Presidency of Bengal, together with the former state of Cooch Behar, which was merged with West Bengal in January 1950. The total area of the state is 29,532 square miles and, in 1951, its population was 24,786,683, of whom about 25 per cent. were Moslems. Bengali is the language spoken by about 83 per cent. of the population. 25

The administration is vested in a Governor assisted by a Council of Ministers and by an elected Legislative Assembly. The headquarters of the government is at Calcutta, which is the capital of the state and which—with its suburbs, was estimated to have a population of 5,007,772 in 1951. 30

West Bengal state, together with East Bengal, the latter now a province of the Dominion of Pakistan, *see* page 13, comprises the former Presidency of Bengal, and, in the main, consists of a great alluvial plain intersected in its southern portion by innumerable waterways and containing the lower valleys and deltas of the Ganges and Brahmaputra. 35 40

In the north are the Himalayan mountains and submontane tracts of Darjeeling and Jalpaiguri, and on the south-east the hills of Tripura and Chittagong, while on the west the Chotā Nāgpur plateau is continued by an undulating tract running through the western portions of Midnapore, Bānkurā, Burdwān and Birbhūm. The general range of the country is, however, very low, and a great fertile plain extends southward from Jalpaiguri to the forests and swamps, known as the Sundarbans, which lie between the area of cultivation and the sea. 45

The Ganges, rising from an ice cave at the foot of the Himalayas, at an altitude of 13,800 feet (4,206^m2), has a general easterly course from the western frontier of the district, with various changes in direction, as far as Rajmahal. From the Rajmahal hills it turns sharply southward, and about 20 miles farther on commences to branch out over the level country, being here about 300 miles, by its windings, from the Bay of Bengal. 50 55

Chart 829.

The Hooghly is its westernmost and most important mouth for the purposes of navigation, and on it stands the city of Calcutta ; the Meghna is the easternmost mouth, and among the number of others
5 between may be mentioned the Mātla, Raimangal, Mālanchā, and Haringhāta ; between the Hooghly and the Meghna is the Ganges delta.

There are services of power vessels along its whole course within West Bengal, and, of the many towns lying on its banks, Patna and
10 Monghyr are the most important.

The Brahmaputra, having its source at no great distance from the Ganges, but on the other side of the Himalayas, joins the Ganges at Goalunda, the combined rivers entering the Meghna at Chandpur and flowing out by that mouth.

15 The Brahmaputra is navigable by river vessels as high up as Dibrugarh, about 800 miles from the sea, but the current is so strong in places that vessels are sometimes unable to make headway for some days. Power vessels run from Calcutta to Dibrugarh all the year round, the time occupied varying from 20 to 25 days. Sirajganj, in
20 the West Bengal district of Sabna, is the most important town on the banks of the Brahmaputra.

Industry.—Trade.—Agriculture engages more than 75 per cent. of the population. The main industries, other than agriculture, are the jute mills, cotton mills, tea industries and coal mining.

25 The principal exports are jute, tea, lac, hides and skins, metals, oil-seeds, coal, coke mica and grain. The principal imports are cotton goods, metals and ores, grain, instruments, sugar, machinery, spices, chemicals, timber and oils.

Midnapore.—Midnapore, the southern district of Burdwān and
30 that which borders the coast, lies between the parallels of 21° 36' and 22° 57' N., and the meridians of 86° 33' and 88° 11' E. ; it is the most populous of the West Bengal districts.

The population, in 1931, was 2,799,093.

The district is fairly healthy, with malaria in some of the low-lying
35 tracts and in its centre ; cholera has considerably diminished, hepatitis is common, and elephantiasis exists in the swampy parts.

Physical features.—The greater part of the district is generally level, but in the north-west are several hills over 1,000 feet (304^m8) high.

The chief river is the Hooghly with its tributaries, Rasūlpur, Haldi,
40 Rupnarayan and Damodar.

The coast canal runs from Geonkhali at the junction of the Rupnarayan and Hooghly rivers, to the Haldi and Rasulpur rivers, thence to Contai and thence into the Balasore district in Orissa state, *see*
page 11 ; the canal is used by coastal craft.

45 **Sundarbans.**—The Sundarbans, lying between the Hooghly and Meghna rivers, and stretching inland to distances of from 60 to 80 miles, includes the district of Twenty-four Parganas in West Bengal and part of the Dacca and Rajshahi divisions of East Bengal. It lies between the parallels of 21° 31' and 22° 38' N., and the meridians of 88° 05'
50 and 90° 28' E.

Forming the lower part of the Ganges delta it is intersected from north to south by the estuaries of that river, the most important being the Hooghly, Matla and Hāriābhāngā in West Bengal, and the Raimangal, Mālanchā, Pussur, Haringhāta, Rabnabad and Meghna
55 in East Bengal. All these rivers are connected with each other by an intricate series of branches, enclosing numerous islands.

Chart 829.

Port Canning on the Matla river is the only port in the West Bengal part of the Sundarbans, but in 1908, it was reported to be nearly deserted.

PAKISTAN.—General remarks.—The Indian Independence Act, which became law on 18th July 1947, made provision for the setting up of Pakistan as a self-governing and independent member of the British Commonwealth of Nations. Pakistan covers approximately 365,900 square miles and, in 1951, had a population of 75,687,000. 5
10

Pakistan is divided into two parts known as West and East Pakistan, which are separated by more than a thousand miles of Indian territory ; only that part known as East Pakistan is included in this volume.

Government.—The executive authority, which is vested in the Sovereign, is exercised by a Governor-General appointed by the Queen, assisted by a cabinet of responsible Ministers of State. The legislative power is vested in a Constituent Assembly. 15

The capital and seat of government is Karachi in West Pakistan, with a population of 359,492 in 1941. The national language is Urdu.

Weights and measures.—*See* under Republic of India, page 4. 20

Currency.—Pakistan did not follow the United Kingdom and India in the devaluation of currency in 1949, and the monetary unit is the Pakistani rupee which equals 2s. 1½d. sterling.

EAST BENGAL.—East Bengal, as a province of Pakistan, was constituted under the Indian Independence Act, 1947. It comprises the eastern territories of the former Presidency of Bengal together with the rich Sylhet district of Assam. The province is divided into the three divisions of Dacca, Chittagong and Rajshahi. The area of East Bengal is about 54,500 square miles and the total population, in 1951, was 42,119,000. The language spoken is Bengali. 25
30

The administration of the province is vested in a Governor assisted by a Council of Ministers. The seat of Government is at Dacca, which is the capital of the province.

Physical features.—Nearly the whole area of East Bengal is a vast alluvial plain, with hardly a hill or even a rock visible for miles. Only in the south-eastern portion of the province is a succession of low mountain ranges which cover the eastern part of the Chittagong division. The most outstanding feature of the province is the network of its rivers, the largest of which are the Ganges and the Brahmaputra with their tributaries. These rivers furnish an admirable and cheap means of transport and bring down vast quantities of fertilising silt which they deposit on the surface of the land. 35
40

The Pussur, one of the estuaries of the Ganges flowing through the Sundarbans, is navigable by sea-going vessels of a draught of 23 feet (7^m0) as far as Chalna anchorage, about 60 miles above its mouth. 45

In the south-eastern part of the province, the chief rivers are the Fenny, Karnaphuli, Sangu and Matamuhari. The Fenny, which forms the north-western boundary of the Chittagong division, is navigable by large native cargo boats for a distance of about 30 miles. The Karnaphuli enters the sea about 10 miles from Chittagong, for which distance it is navigable by sea-going vessels, and by small launches as far as Rangamati ; native cargo boats can reach Kasalang, about 100 miles from its mouth, and during the rains river vessels can 50

Chart 829.

ascend to Barkal rapids, about 20 miles higher. The Sangu river, which enters the bay about 5 miles southward of the Karnaphuli, has a course of 168 miles ; it is tidal as far as Bandarban, and is navigable
 5 by large native cargo boats for a distance of 30 miles throughout the year. The Matamuhari has a course of 96 miles, and flows out through a broad delta, somewhat resembling the Sundarbans, eastward of Kutubdia island ; it is navigable, through its extensive delta by the largest boats.

- 10 The main rivers are connected by north and south cross-channels, which are partly artificial, through which inland communication can be maintained, southward from Chittagong to Cox's Bāzār at all seasons.

Ports.—The ports are Chittagong, Chalna anchorage and Cox's Bāzār.

- 15 **Health.**—Owing to the number of waterways connecting the tidal rivers, and the innumerable tanks, neither of which are clean, and form breeding places for mosquitoes, malarial fever is very prevalent, and cholera occasionally breaks out in a virulent epidemic form ; the other most prevalent diseases are those of the skin and ear and intestinal
 20 worms.

Chart 830.

BURMA.—Burma, formerly a group of provinces under British rule, became an independent republic on 4th January, 1948.

- The republic, the coast of which forms almost the whole of the
 25 eastern shore of the Bay of Bengal, is situated between the parallels of 9° 58' and 27° 20' N., and the meridians of 92° 11' and 101° 09' E. The Arakan, Irrawaddy, Pegu and Tenasserim divisions border the coast. In 1941, the total population was 16,823,798, about 85 per cent. of whom were Buddhists.

- 30 **Government.**—The Government is vested in the President, assisted by a Chamber of Deputies and a Chamber of Nationalities. The capital and seat of Government is Rangoon. The official language is Burmese ; the use of English is permitted and it is taught in secondary schools as a compulsory second language.

- 35 **Products.—Industry.**—Agriculture is the chief industry of the province, and supports nearly three-quarters of the population, rice being the principal crop. Next in importance to rice is the output of petroleum, the most important oilfields being at Yenangaung, Chauk and Lanywa ; there are oil refineries in the Rangoon area. Teak
 40 wood is exported in large quantities, and the forests play an important part in the industrial life of the province ; paraffin wax is exported.

- Burma is rich in mineral resources. Besides petroleum, tin and wolfram are found chiefly in the Tavoy and Mergui districts ; lead, silver, zinc, copper, nickel, cobalt and antimony are found in the
 45 Northern Shan states. The principal gem stones are rubies and sapphires ; there are jade and amber mines. Coal and lignite are fairly common, but the deposits have not been successfully exploited. There is an important cement factory at Thayetmyo.

- Native manufactures are hand silk-weaving, Burmese wood-carving,
 50 Bassein and Mandalay parasols, lacquer work, and bronze figures.

Weights and Measures.—

- | | |
|------------------------------|---------------|
| 1 Pulgat | = 1 inch. |
| 1 Taim or Maik (8 Thit) | = 5·5 inches. |
| 1 Tounge or Saading (4 Taim) | = 22 inches. |
| 55 1 Lan (4 Tounge) | = 88 inches. |

Chart 830.

1 Tha (7 Toun)	= 154 inches.	
1 Okethapah	= 85.56 yards	
1 Tain	= 1069.44 yards.	
1 Dain (4 Tain)	= 2.430 miles.	5
1 Uzena	= 15.555 sq. miles.	
1 Lamyet	= 1 gill.	
1 Salay	= 1 pint.	
1 Sah	= 1 gall.	
1 Saik	= 1 peck,	10
1 Teng	= 1 bushel.	
1 Coyan (100 Teng)	= 12.5 quarters.	
1 Large Ruay	= 3.937 gr. Troy.	
1 Bai or Anna	= 15.75 gr. Troy.	
1 Moo	= 31.5 gr. Troy.	15
1 Mat	= 63 gr. Troy.	
1 Tikal or Kyat	= 252 gr. Troy.	
1 Viss or Piakthà	= 3.6 lbs. Av.	

Currency.—The monetary unit is now the *kyat* (formerly the Burma rupee) divided into 100 *pyas*; the *kyat* equals 1s. 6d. sterling. 20

Akyab—Akyab, the northern coastal district of the Arakan division of Burma, lies between the parallels of 21° 27' and 19° 47' N., and the meridians of 92° 11' and 93° 58' E.

The population, in 1931, was 637,580.

Physical features.—The district consists of the level tract lying 25 between the sea and the Yoma mountains, and of the broken country formed by their western spurs and valleys. In the western part, between the Nāf and Mayu rivers, and terminating near the mouth of the latter, is the steep Mayu range, the southern part of which runs parallel with, and not far from, the coast. The low ground 30 near the sea is covered with forests of mangrove.

The rivers generally flow from north to south. The three principal rivers are the Mayu, Kaladan and Lemro, which at first are only mountain torrents, but, in the plains, spread out into a network of tidal channels, and form a delta as they merge into the sea. The 35 Kaladan, the longest and most important of these, rises in Blue mountain, and flows into the sea at Akyab.

Port.—Akyab is the principal port.

Kyaukpyu.—Kyaukpyu, the next district south-eastward of Akyab, lies between the parallels of 18° 40' and 20° 40' N. and the meridians 40 of 93° 13' and 94° 26' E.

The population, in 1931, was 220,292.

Physical features.—The mainland in the northern and eastern parts is highly mountainous and forest-clad; the southern portion is cut up into numerous islands by a network of tidal creeks. There are 45 no rivers of any importance in the district; Dalet chaung and An chaung are navigable by boats for distances of 25 and 32 miles, respectively, but above that are mountain torrents.

Port.—The principal port is Kyaukpyu.

Health.—The climate is notoriously unhealthy; malarial fevers 50 and bowel complaints are prevalent, the former at the beginning and the latter at the end of the rains, and the town of Kyaukpyu is said to be situated in a very unhealthy area.

Sandoway.—Sandoway district, which adjoins Kyaukpyu district on its south-eastern side, is a narrow strip lying between the parallels of 55 17° 15' and 19° 32' N. and the meridians of 94° 00' and 94° 52' E.

Chart 830.

The population, in 1931, was 129,245.

The climate is considered to be more pleasant and healthy than other parts of Arakan.

- 5 *Physical features.*—The country is mountainous, Arakan Yoma range being the southernmost spur thrown out from the mass of hill-country stretching north and south along the western edge of Burma. In the northern part some of the peaks of the Yoma mountains attain an elevation of about 5,000 feet (1,524^m0), but they become lower
10 southward, and abreast Gwa chaung the elevation is about 900 feet (274^m3). Nantha kyun, a mud volcano, which emits mud and marsh gas, lies off the coast; it was in eruption in 1908.

- The rivers draining the country are only mountain torrents to within a few miles of the sea. The Sandoway is navigable by boats
15 as far as the town of Sandoway.

Ports.—The principal anchorages are off the mouth of the Sandoway river and at Gwa.

- Bassein.**—Bassein, a district of the Irrawaddy division of Burma, lies between the parallels of 15° 50' and 17° 30' N. and the meridians
20 of 94° 11' and 95° 28' E.

The population, in 1931, was 571,043.

The climate is rather relaxing, though the strong sea breezes, which spring up in the afternoons, temper the summer heat.

- Physical features.*—The Yoma mountains, entering the district at
25 its north-western corner, and stretching down its western side at no great distance from the sea, divide it into two unequal parts, the main portion, a flat alluvial plain, being on the eastern side.

- The whole country is intersected by tidal channels, mostly unimportant, the principal river being the Bassein, which, branching off
30 the Irrawaddy above Henzada, flows almost due south through the district and enters the sea at Hainggyi kyun. Inye lake, in the north-eastern part of the district, has a depth of about 15 feet (4^m6) in the dry season.

Port.—Bassein is the principal port.

- 35 **Myaungmya.**—Myaungmya (Myangmya), the delta district, lies immediately eastward of Bassein, and between the parallels of 15° 44' and 16° 55' N., and the meridians of 94° 36' and 95° 35' E.

The population, in 1931, was 444,784.

- Although enervating, the climate is not altogether unhealthy, and
40 its proximity to the sea makes it more equable than farther inland.

- Physical features.*—It consists of a number of flat, fertile islands, separated by rivers or tidal creeks, all branches of the Irrawaddy, mostly navigable; with the exception of a small tract of rising ground, about 30 miles southward of Myaungmya town, the general surface is
45 little above the rise of spring tides. Near the coast, stretches of mangrove jungle and dani palms border the mud creeks, while farther northward are plantain groves and pagodas, otherwise it would present only a waste of wide rice flats, chequered with strips of grass and tree jungle.

- 50 The western side of the district is skirted by the Panmawadi, which flows into Bassein district, but leaves a branch, the Thetkethaung, still bordering it. The Pyamalaw flows through the centre of the district and joins the sea by two mouths, named the Pyamalaw and the Pyinzalu. For other branches of the Irrawaddy, *see* page 365.

- 55 *Ports.*—The ports, or rather stopping places of the steamers within the district, are Myaungmya, Wakema, and Shwelaung.

Chart 830.

Pyapon.—Pyapon is the delta district eastward of Myaungmya, and is bounded on the east by the China Bakir river. It lies between the parallels of 15° 40' and 16° 41' N., and the meridians of 95° 06' and 96° 06' E. 5

As in the case of Myaungmya, it is of recent formation, having been a stretch of unreclaimed jungle until recent years.

The population, in 1931, was 334,158.

The climate, although damp and depressing, is healthy.

Physical features.—It consists of a vast plain, intersected by tidal 10 creeks and waterways, and, with the exception of very small areas, named kondans, which are narrow strips of land from 4 to 10 feet (1^m2 to 3^m0) above the level of the plain, it is subject to inundation at high water, spring tides.

The rivers, which are the south-eastern portion of the network 15 forming the outlet of the Irrawaddy, are all tidal, and are, for the most part, navigable by small craft at all seasons of the year. The western mouth of the China Bakir river is known as the Pyapon. Between it and the Irrawaddy the Bogale (Dala) enters the sea at Pyindaye; the lower reaches of this river are separated from the 20 Irrawaddy by two large islands.

Ports.—Pyapon, Kyaiklat, and Dedaye are the principal ports where steamers call.

Hanthawaddy and Rangoon.—Hanthawaddy, a district of the Pegu division of Burma, lying on the eastern side of Pyapon, lies 25 between the parallels of 16° 19' and 17° 00' N., and the meridians of 95° 52' and 96° 55' E.; the Coco and Preparis islands form a part of the district.

In the centre of the district, and completely surrounded by it, is the separate district of Rangoon. 30

The population of Hanthawaddy district, in 1931, was 408,831, and of Rangoon town, in 1941, was about 500,000.

Physical features.—It is a vast, deltaic plain, broken only by the spurs of the Pegu Yoma, which separate its northern part from Pegu; these mountains attain an elevation of 2,000 feet (609^m6). The sea 35 coast is low, exposing large stretches of mud at low water; inland, except in the vicinity of Rangoon, the land consists of rice cultivation and swamp, relieved by scrub jungle, with numerous waterways near the sea.

The main stream is the Hlaing, which, entering the district near its 40 northern end, flows southward through it, and is navigable throughout the district by native craft. The Rangoon river, which, as the Pegu river, joins the Hlaing near Rangoon, flows southward into the Gulf of Martaban.

Bassein creek, connects the Rangoon river with the China Bakir, 45 and thus with the main stream of the Irrawaddy; during the rains when the river is high, Panglaing river takes the place of Bassein creek as the most direct route to the Irrawaddy.

The Twante canal shortens the distance between Rangoon and the China Bakir river, and, although shallow, is much used by small 50 steamers and boats, being the quickest route from Rangoon to the main stream of the Irrawaddy.

Port.—Rangoon is the principal port.

Health.—The moist and depressing climate is not altogether unhealthy. The heat is oppressive from the middle of March till the 55 rains break in May.

Chart 830.

Thaton.—The district of Thaton lies between the Sittang and the Gyaing rivers, between the parallels of 16° 28' and 17° 51' N., and the meridians of 96° 39' and 98° 20' E.

- 5 The population, in 1931, was 532,628.

The climate, moist and oppressive, is generally salubrious.

- Physical features.*—It is intersected by three main hill ranges; the Dawna range, in the eastern and north-eastern parts, varies in elevation from 1,000 to 5,000 feet (304^m8 to 1,524^m0); westward of
10 the Dawna range and separated from it by a wide plain, are the Martaban hills, which are a continuation northward and westward from Moulmein of the Taungnyo range; and in the north-western part of the district, between the Martaban hills and the Sittang estuary, is a limestone range entering from the north, the western spur of
15 which, known as the Kelatha hills, rising to a height of 3,650 feet (1,112^m5) opposite Sittang village.

- The Sittang river forms the western boundary. The Bilin river enters the district from Salween district and flows between the Martaban and Bilin hills. The Salween river, entering the district at the
20 northern corner, flows southward, dividing it, roughly, into halves; at Moulmein, where it enters the Amherst district, the river is divided into two mouths by Bilugyun; the northern mouth, known as the Darebaw river, forms the northern border of the district. The Gyaing, formed by the junction of the Hlaingbwe and Haungtharaw
25 rivers, forms the south-eastern border of the district, joining the Salween river near Moulmein. The Gyaing is encumbered by islands and sandbanks, but is navigable by native boats and launches all the year round.

Port.—Martaban is the chief port.

- 30 **Amherst.**—Amherst, the district lying southward of Thaton, lies between the parallels of 14° 56' and 17° 02' N., and the meridians of 97° 27' and 98° 51' E.; it is in the Tenasserim division of Burma.

The population, in 1931, was 516,233.

- Physical features.*—The district consists, for the most part, of
35 alluvial plain, shut in on the west by the low Taungnyo range running parallel with the coast, and on the east by the Dawna range, from which numerous spurs extend south-eastward; in the extreme east is a narrow, densely-wooded region.

- The principal rivers are the Gyaing, Salween, Ataran, and Thaungyin.
40 The Ataran, formed by the junction of the Zami and Winyaw streams in the southern part of the district, is narrow, deep and sluggish, running, in parts, between high banks and dense, overhanging foliage; it joins the Salween river at Moulmein.

- The Moulmein river is the name given to the southern mouth of the
45 Salween river. It is the navigable entrance to Moulmein harbour.

The Thaungyin rises in the Dawna hills, joins the Salween after a course of about 200 miles, and has a width of from 100 to 1,000 feet (30^m5 to 304^m8), but is not navigable on account of rapids.

Port.—The principal port is Moulmein.

- 50 **Tavoy.**—Tavoy, the district next southward of Amherst, lies between the parallels of 13° 16' and 15° 06' N., and the meridians of 97° 46' and 99° 12' E.

The population, in 1931, was 179,964.

- Physical features.*—It consists of a rugged tract, 150 miles long
55 and 50 miles wide at its widest part, and, except for the Tavoy basin and a narrow strip along the coast, is composed of hills. The ranges

Chart 830.

run generally north and south, one dividing the Tavoy river from the sea, a second forming the watershed between the Tavoy and Great Tenasserim rivers, while the third is near the boundary between the district and Thailand. The highest peak is Myinmoletkat (Myeng-moletkhat), with an elevation of 6,800 feet (2,072^m6).

Great Tenasserim river, rising in the Myinmoletkat peak, flows northward, then sharply turns eastward, and runs into the Mergui district; in the dry season it is only navigable by canoes.

The Tavoy river rises in the northern part of the district, flows southward past Tavoy town to the sea; it is navigable by shallow draught power vessels to Tavoy, and for 40 miles farther by boats.

Port.—Sinbyubyin is the chief port.

Mergui.—Mergui, the southernmost district of Burma, lying between the parallels of 9° 58' and 13° 28' N., and the meridians of 97° 30' and 98° 35' E., includes the islands of the Mergui archipelago from Tavoy island to Christie island.

The population, in 1931, was 161,987.

The district is unusually healthy for a tropical climate, and malaria is little known.

Physical features.—In the northern part the Great Tenasserim valley is separated from the sea by a mountain range, having Myinmoletkat peak on the northern border, and between this range and the coast is a fertile plain watered by small streams. In other parts such level land as exists is mostly covered at high water by the sea, or, inland, flooded during rains.

Great Tenasserim river, rising in Tavoy, enters the district about 140 miles above Tenasserim village, where it turns back on itself and flows into the sea; Little Tenasserim, flowing northward, joins it at the village of the same name.

Lenya river, south-westward of and nearly parallel with the Little Tenasserim river, after trending north-westward flows direct to the sea.

Pakchan river, rising near the Lenya, flows southward to Victoria point, and from the town of Pakchan to its mouth forms the boundary with Thailand.

Port.—Mergui is the principal port.

Mergui archipelago.—Mergui archipelago extends southward from Tavoy island, in lat. 13° 13' N., to Similan islands, in lat. 8° 30' N., and in some cases to a distance of 70 miles off the mainland; it consists of about 800 islands, covering an area of roughly 10,000 square miles.

They are nearly all high, and on the larger ones the mountain ranges run north and south, parallel with the coast, the islands being in two parallel chains; the whole archipelago lies within depths of 50 fathoms (91^m4). Dense jungle covers all the islands, coming down to the water's edge in the case of the more precipitous ones, while the lower islands are often fringed with mangroves; a conspicuous feature of the northern islands is the large number of blasted trees which stand above the jungle, reported to have been caused by a cyclone.

The islands are almost uninhabited except by Salones, or sea-gypsies, who wander from one fishery ground to another in their boats.

There is an influx of people to the archipelago for the pearling season.

Hastings harbour and the surrounding islands are frequently visited by the Salones or Mawkens who put in there for fresh water. They live in boats called kabangs, built principally of reeds. These kabangs

Chart 830.

are very crude and are about 25 feet (7^m6) in length ; they usually shelter a family of anything up to 8 persons and one or two dogs. The Salones are of a very nervous disposition and are terrified of strangers, but after a little coaxing and kindness they readily become friendly.

Products.—The most important product is the shell of the mother-of-pearl oyster, for which divers go down to a depth of 28 fathoms (51^m2) and occasionally to 30 fathoms (54^m9) ; the season is from September to May, and diving is only carried on at neap tides. Green snails and trocas shells are gathered for their mother-of-pearl shell, but owing to the limited amount of coral bottom, the bêche-de-mer is not found in any great quantity ; the edible birds' nests of the swift and the eggs of the large turtle are collected.

THAILAND.—General remarks.—The northern part of the Thai monthon or district of Phuket forms the southernmost part of the eastern side of the Bay of Bengal. The monthon has a coastline of about 250 miles between the Burmese frontier at the mouth of Pakchan river and the northern boundary of the state of Perlis, but only that part of the coast between the mouth of Pakchan river and Hlām Phra Chao, the southern extremity of Kō Phuket, together with the off-lying islands, is included in this volume. The principal industry of the monthon of Phuket is the working of tin, and the principal town is Phuket, situated on the eastern coast of Kō Phuket and described in the Malacca Strait Pilot.

The principal export from the monthon is tin ore, about two-thirds of which is from Kō Phuket ; the imports are rice and other foodstuffs, iron and steel manufactured goods, textiles, etc.

The health in the monthon is, on the whole, good. Kō Phuket has in recent years been free from epidemic diseases. The town of Phuket is connected with the general telegraph system of the Malay peninsula.

Chart 828.

FRENCH POSSESSIONS.—General remarks.—Negotiations, which are in progress in regard to the transfer to the Republic of India in full sovereignty, of French Indian possessions, had not reached a conclusive stage in 1953 ; on such transfer being concluded, French subjects and citizens of the French Union domiciled in these possessions, will automatically become Indian citizens.

The only French possessions on the shores of the Bay of Bengal are the settlements of Pondichéry and Karikal, both being enclaves in the state of Madras.

Karikal.—The small French settlement of Karikal is situated in the Tanjore district and consists of a tract of territory stretching along the coast between Tranquebar and Nagore. It has an area of about 53 square miles and is divided into 6 communes containing 110 villages ; it is governed by an Administrator who is subordinate to the Commissioner at Pondichéry. The soil is very fertile and is irrigated, and periodically inundated, by numerous tributaries of Cauveri river.

Karikal, the chief town of the settlement, is situated on the northern bank of Arasālār river about one mile above its mouth ; the town is connected with the general railway system of India.

In 1941, the population of the settlement was 60,555.

Pondichéry.—Pondichéry is the chief of the French settlements in India and the town of Pondichéry is its capital and the seat of Govern-

Chart 828.

ment. The settlement contains eight communes under a Governor who is also the Commissioner responsible for the military command and administration of all French possessions in India.

The town of Pondichéry is situated in the South Arcot district, about 13 miles northward of Cuddalore and the settlement comprises a number of isolated areas in the same district. The town is connected with the general railway system of India.

Production and industry.—The principal crops are rice and ground nuts.

The principal exports are oil-seeds and vegetables and the chief imports, manufactured goods and textiles. Weaving is the chief industry.

Chart 830.

ISLANDS IN THE BAY OF BENGAL.—Preparis island.— **Coco group.**—Preparis island and the Coco islands, situated about 73 miles and 120 miles, respectively, south-south-westward of Cape Negrais, form part of the Hanthawaddy district of Lower Burma for administrative purposes.

Andaman islands.—The Andaman islands are a group of islands, consisting of about 200 islands and rocks, lying between the parallels of 10° 30' and 13° 40' N., and the meridians of 92° 11' and 93° 07' E.

The principal islands are North, Middle and South Andaman, Baratang and Rutland island, situated close together and forming one block, Little Andaman island being about 30 miles farther southward. The chief outlying islands are North Sentinel, Barren island, 1,158 feet (352^m9) high, a volcano which has been quiescent for over 100 years, and Narcondam, 2,330 feet (710^m1) high, also an extinct volcano, which lies about 70 miles eastward of the main group.

Between 1858 and 1942, the islands were used by the Government of India as a penal settlement for convicts serving life sentences and long terms; in March 1942, the islands were occupied by the Japanese and were not re-occupied by the Government of India until October 1945. With the re-occupation of the islands the penal settlement was abolished.

The Andamans are administered by the President of the Republic of India acting through a Chief Commissioner and an Advisory Council of 5 members.

The seat of Administration is at Port Blair in South Andaman island; in 1945, the population was about 17,750.

Physical features.—They consist of a mass of hills enclosing very narrow valleys, the whole covered by exceedingly dense tropical jungle. The hills rise to a considerable elevation, especially on the east coast, the chief heights being Saddle hill, 2,402 feet (732^m1), in North Andaman; Mount Diavolo, 1,678 feet (511^m5), in Middle Andaman; and Koyob, 1,505 feet (458^m7), in South Andaman; Mount Ford rises to 1,422 feet (433^m4) on Rutland island. Little Andaman island, except at its northern extremity, is practically flat. There are no rivers and few perennial streams in the group.

No violent earthquakes are reported, although the group lies in a line of fault; minor earthquakes occurred in 1868, 1880, 1881, 1882, 1883, 1886, 1894, and 1899.

Production.—Trade.—The principal crops raised are rice, pulse, maize, sugar-cane, and turmeric; tea, coconut, Bahamas aloe, rubber, and hemp are cultivated. Red clay for bricks, a reddish marble,

Chart 830.

red ochre, and mica, in workable quantities, are all found, and edible birds' nests, oysters, turtle, and tortoise-shell are obtained.

Valuable woods are exported ; also tea, coffee, cocoa, rubber, edible birds' nests (which are a government monopoly), turtle, and tortoise-shell.

Ports.—The islands are deeply indented, forming a number of harbours, some very spacious ; the principal are Temple sound, Port Anson, Port Campbell, Port Mouat, and Macpherson strait, all on the west coast. On the east coast are Port Cornwallis, Stewart sound, Elphinstone harbour, Colebrooke passage, Port Meadows, and Port Blair.

Caution.—Shipwrecked mariners are cautioned that, in 1908, the following places were inhabited by Jarawas, all of whom were hostile, and by Onges, some of whom were hostile and killed on sight :—Southern and western coasts of Little Andaman island and Hut bay on its eastern coast ; North Sentinel island ; southern coast of Rutland island, Port Campbell and the coast a few miles northward of it on the western side of South Andaman island. Elsewhere they would find the people not only friendly and helpful, but likely to give immediate notice of their predicament to Port Blair. In 1922, however, the natives at Hut bay were reported to be both numerous and friendly.

In 1932, all the Onges were reported to be friendly. The Jarawas, all of whom will kill on sight, inhabited the area northward of a line drawn from Florence point on the west coast to, approximately, Lakera Baranga, situated about 4 miles northward of North point, the northern entrance point of Port Blair, on the east coast, thence, approximately to Andaman strait. The Jarawas also occupied North Sentinel island. Rutland island was occupied by Onges.

Regulations.—See page 40.

Nicobar islands.—The Nicobar islands are a group of islands lying between the parallels of 6° 45' and 9° 15' N., and the meridians of 92° 40' and 93° 55' E.

The Nicobars are a dependency of the Andaman islands, consist of twelve inhabited, and seven uninhabited, islands, and are mostly hilly and undulating. They are generally divided into the Northern, Central and Southern groups.

The population, in 1945, was about 11,250, of which more than two-thirds occupied Car Nicobar.

Physical features.—The chief summits are Mount Thuillier, 2,105 feet (614^m6), on Great Nicobar ; and Mount Deoban, 1,428 feet (435^m2), and Empress peak, 1,420 feet (432^m8), on Little Nicobar.

Severe earthquakes may be expected, and ones of great violence were recorded in 1847, in 1881 (with a tidal wave), and milder shocks in 1899.

The only island with any rivers is Great Nicobar, on which are Galathea river or Dak Kea ; Alexandra river or Dak Anaing ; and Dagmar river or Dak Tayal.

Production.—Industry.—Coconuts and tobacco are grown. The natives are good carpenters, and pottery for domestic use is manufactured. Coconuts are exported.

Ports.—Nancowry, between Kamorta (Camorta), Nancowry, and Trinkat islands, is a fine landlocked harbour, and there is a small one between Pulo Milo and Little Nicobar, besides which there are a number of good anchorages.

Regulations.—See page 40.

Chart 830.

Health.—The climate is very hot, except when raining, and unwholesome for Europeans, being in some places dangerously subject to malaria.

CURRENTS.—General remarks.—The seasonal alternations of atmospheric pressure over the continent of Asia give rise to the South-west and North-east monsoon winds. The direct effect of these winds is to develop seasonal currents in opposite directions in the surface water of the Bay of Bengal. The South-west monsoon thus tends to produce an easterly drift in the open waters of the Bay, together with a current setting northward and north-eastward along the east coast of India to the head of the Bay. The North-east monsoon tends to produce a westerly drift in the open waters of the Bay and a current setting south-westward and southward along the east coast of India from the head of the Bay. Owing, however, to the relatively small area of the Bay, and to the fact that, except on its southern side, it is entirely surrounded by land, two other factors influence the direction of the current. Each of these is an indirect effect of one of the monsoons, as explained below. The resulting general circulation of the Bay is intricate and differs in greater or lesser degree during every month of the year; this is best shown by a series of monthly charts, *see* Figures 1-12.

In all monsoon areas, to which the Bay of Bengal is no exception, the currents show a considerable degree of variability, and even in the height of each monsoon, currents may sometimes be met setting in the opposite direction to the monsoon current or, in general, in any direction round the compass. In either monsoon, the wind fluctuates considerably in strength and to some extent in direction, owing to variations in the distribution of atmospheric pressure. Other winds may also intervene for a time; in these are included the winds of depressions and cyclones. At the transition periods of the monsoons, the currents are still more variable. Figures 1-12 therefore do not represent the direction of current which will necessarily be experienced in each month; they can only indicate the resultant movement of water during each month which is called the general circulation. Owing to the probable intricacies of the water movements in detail, even the general circulation can only be shown in broad outline. Information about currents in coastal regions, where available, will be found in the appropriate places in the body of this volume.

The indirect effects of the monsoons, referred to above, are as follows. The South-west monsoon wind is established all over the Bay in May, and gradually strengthens, the maximum strength being in July and August. The direct effect of this wind is to drive the water across the Bay and along the east coast of India to the head of the Bay, and so pile it up on the eastern side. There is no exit for the accumulating water in the north-eastern part of the Bay; the head of water has therefore to be released by taking a westerly direction across the head of the Bay in exactly the opposite direction to the direct flow produced by the monsoon, which it begins to overcome when the accumulation of water reaches a sufficient amount. A counterclockwise circulation then begins in the extreme north of the Bay; this occurs in July, *see* Figure 7. This counterclockwise circulation extends southward and westward in subsequent months, still remaining centred at the head of the Bay, until in September it forms the predominant circulation of the whole of the Bay westward of the

GENERAL SURFACE CURRENT CIRCULATION

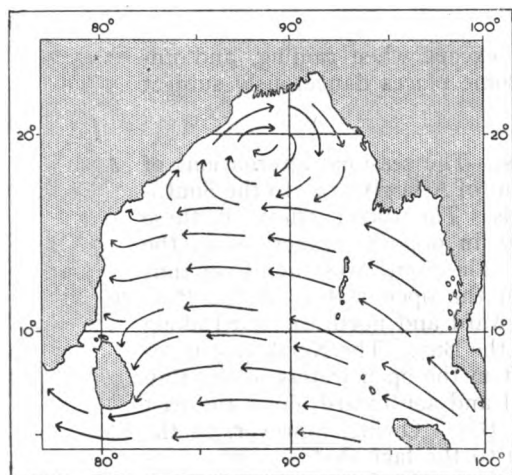


Fig. 1.—January

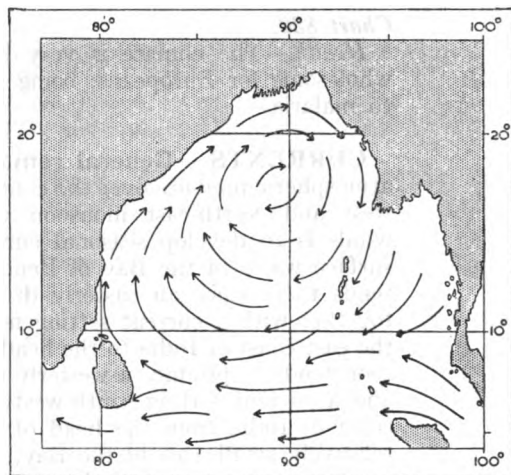


Fig. 2.—February

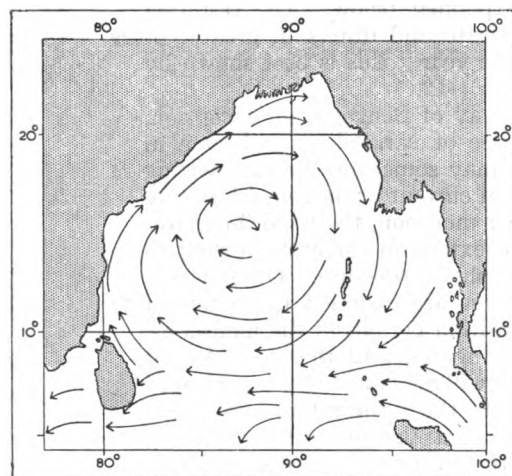


Fig. 3.—March

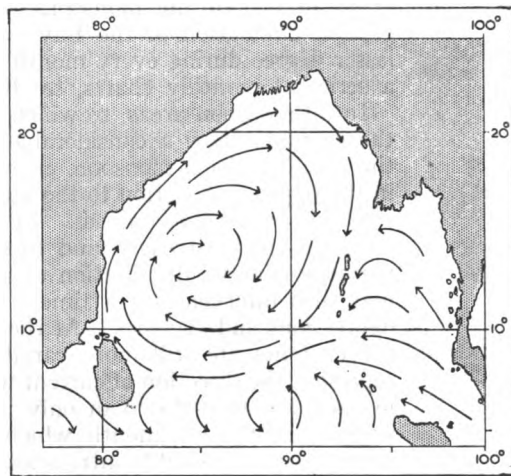


Fig. 4.—April

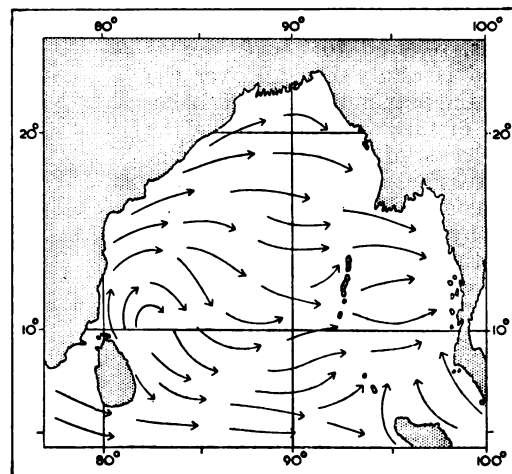


Fig. 5.—May

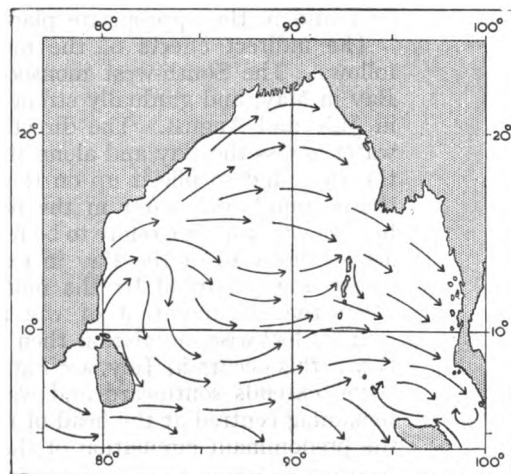


Fig. 6.—June

GENERAL SURFACE CURRENT CIRCULATION

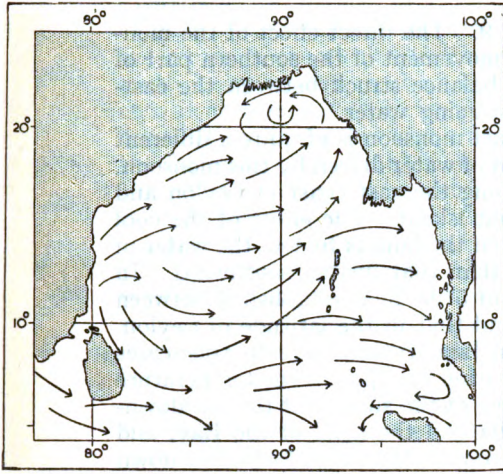


Fig. 7.—July

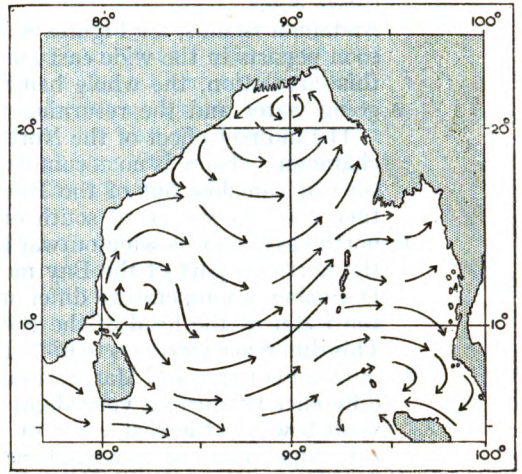


Fig. 8.—August

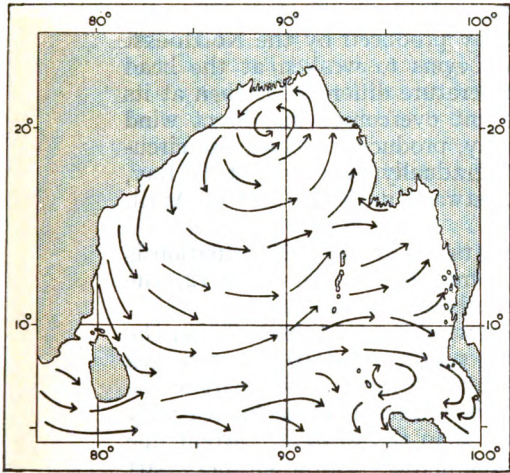


Fig. 9.—September

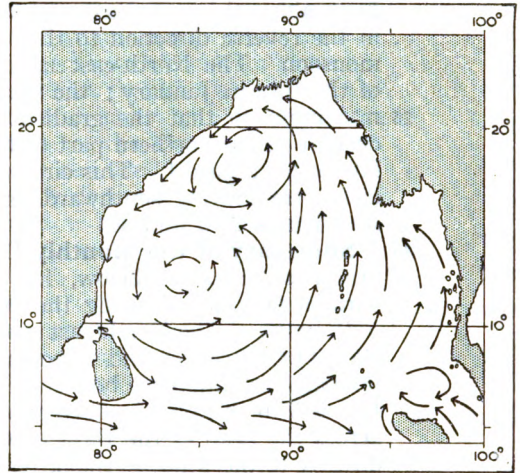


Fig. 10.—October

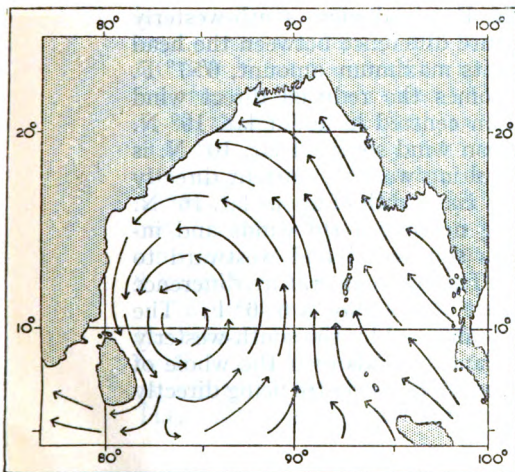


Fig. 11.—November

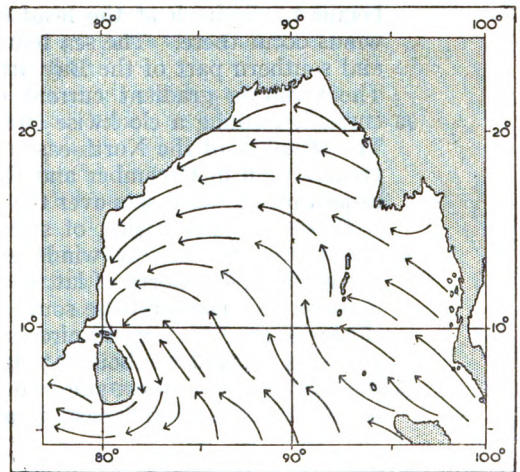


Fig. 12.—December

Chart 830.

Andaman islands, *see* Figures 8 and 9. The direct effect of the monsoon persists in the wide east-going movement of the southern part of this circulation, the whole being a balance struck between the east-
5 going water and the returning west-going water.

The indirect effect of the North-east monsoon is of quite a different character. There is no accumulation of water driven by this monsoon, since it can flow out of the Bay along the east coast of Ceylon and thence to the westward south of that island. The effect of the cool
10 north-east wind blowing outward from the land is to cool the water in the northern part of the Bay more than that further southward. In December a temperature difference of 5° - 6° F. is established between the water at the head of the Bay and that in the latitude of Ceylon. This difference increases to 6° - 7° F. in January and thereafter decreases
15 during February and March, disappearing by April. The temperature difference produces a very slight slope of the surface of the sea downward towards the east coast of India and the head of the Bay, and this slope gives rise to a gradient current. Water tends to flow down the slope towards the coast. The effect of the Earth's rotation is to
20 divert this flow 90° to the right, with the result that the actual current flows along the east coast of India towards the head of the Bay, i.e. in the reverse direction to that directly produced by the North-east monsoon. The North-east monsoon begins to weaken at the head of the Bay in January; the sea temperature difference is then at its
25 maximum so that the gradient current overcomes the direct wind current in the northern part of the Bay, producing a clockwise circulation, *see* Figure 1. This circulation gradually extends over the Bay, its centre moving southward and westward until the end of April, *see* Figures 2, 3 and 4.

30 **Summary of the Monthly Currents.**—The general circulation is briefly summarised below, for each month, *see* Figures 1-12, the various factors producing the current being mentioned.

December.—The North-east monsoon wind is established all over the Bay, but is weaker and more variable south of lat. 10° N. The sea
35 temperature difference between the head and the southern part of the Bay is 5° - 6° F., but the current which would result from this (easterly across the head of the Bay) is weaker than the westerly current due directly to the wind, so the latter predominates. In the southern part of the Bay the current sets between north and north-west.

40 *January.*—The strength and constancy of the North-east monsoon begins to diminish at the head of the Bay and more south-westerly winds occur there. The sea temperature difference between the head and southern part of the Bay attains its maximum amount, 6° - 7° F. The resulting gradient current overcomes the reduced direct wind
45 current, forming a clockwise circulation centred in about lat. 19° N. The strength of the North-east monsoon wind south of lat. 10° N. is greater than in December and the resulting westerly current directly caused by the wind sets over the whole Bay south of about lat. 16° N.

February.—The region of slackening north-easterly winds and increasing south-westerly winds extends southward and westward to
50 the whole region north of lat. 15° N. The sea temperature difference between the head and the southern part of the Bay is 5° - 6° F. The clockwise gradient current circulation, enhanced by the south-westerly winds, is centred in about lat. 16° N. and extends over the whole of
55 the Bay, the broad west-going current south of its centre being directly impelled by the North-east monsoon wind.

Chart 830.

March.—The currents are essentially the same as in February, but the centre of the clockwise circulation is somewhat further west and south, being centred in about lat. 15° N. The sea temperature difference is now only 2° - 3° F., so that the clockwise circulation is mainly 5 impelled by the south-west winds which are now predominant over the Bay north of lat. 15° N. and west of long. 90° E. South of lat. 15° N. the North-east monsoon still aids the westerly current, but the wind is weaker than in February.

April.—The monsoon is in transition in the southern part of the 10 Bay and south-west winds are beginning to predominate there. There is no longer any difference of sea temperature between the head and southern part of the Bay. The clockwise circulation, now centred in lat. 13° - 14° N., persists over most of the Bay westward of the Andaman islands. 15

May and June.—The South-west monsoon is established all over the Bay, with a general easterly set of current directly due to this. Traces of the clockwise circulation persist north-eastward of Ceylon. The monsoon strengthens in June.

July.—The South-west monsoon continues to strengthen and the 20 accumulation of water in the north-eastern part of the Bay begins to take effect, overcoming the direct monsoon circulation in the head of the Bay and forming a small counterclockwise circulation there.

August.—The South-west monsoon retains its full strength and the increase of accumulated water produces a more extended counter- 25 clockwise circulation covering the whole of the Bay north of about lat. 15° N., but remaining centred near the head of the Bay.

September.—The South-west monsoon is decreasing and the counter-clockwise circulation produced by the flow back of the accumulated water extends to cover most of the Bay westward of the Andaman 30 islands, its centre remaining as before.

October.—The monsoon is in transition, with the South-west monsoon still predominating to some extent south of lat. 15° N. and the North-east monsoon beginning to predominate north of that parallel. The counterclockwise circulation of the previous months separates 35 into two such circulations. The northern one of these is impelled by the north-east wind and the southern one by the south-west wind.

November.—The North-east monsoon is established over the Bay north of lat. 10° N. The northern of the two counterclockwise circulations of October has disappeared being merged into a general westerly drift. The southern of the two circulations persists and is centred in lat. 10° N. in the western part of the Bay. 40

Strength of currents.—The following information is based on observations made during the period 1910-1931. In the open waters 45 of the centre of the Bay, lats. 10° - 16° N., longs. 84° - 92° E., no current attains the rate of 2 knots; the maximum is about $1\frac{1}{2}$ knots. In the southern part of the Bay, south of lat. 10° N., a small percentage of currents exceeding 2 knots occur in May to October; very occasionally a maximum of 3 knots or slightly more is reached. Currents exceeding 50 2 knots in this region are rarely met during the rest of the year.

The strongest currents in the Bay of Bengal are found in some of the coastal areas on the western side of the Bay. The region of the south-east and south coasts of Ceylon is subject to strong currents, especially in October to December, *see* Currents off Ceylon below. 55 These attain maximum rates of 4-5 knots on the south-east coast.

Chart 830.

The north-going current through Pamban pass into Palk strait frequently attains a rate of 5-6 knots during the South-west monsoon period.

- 5 In the vicinity of Madras, the north-going current in March and April may exceed 2 knots, with a maximum of about 3 knots; the same applies to the south-going current in July and August.

During January to April inclusive, north-going currents with rates of 2-3 knots are met off the east coast of India between Sacramento shoal and Gopalpur; these currents may reach a rate of 4 knots in the vicinity of Sacramento shoal.

- Currents off Ceylon.**—The position of Ceylon is a meeting or dividing point for the currents of the Indian ocean, the Arabian sea and the Bay of Bengal. In depths of less than 100 fathoms (182^m9),
15 or within a distance of from 12 to 15 miles of the coast, the currents are very variable, and currents may be experienced, on both the eastern and western sides of the island, setting parallel to the coast. These inshore currents may be in opposite directions, at the same time, and within a few miles of one another. On the east coast, between
20 Little Basses reef and Trincomalee, in March to August, the current direction often reverses, without apparent cause, but either direction is usually parallel to the coast.

- Further offshore, the general flow of current is as follows. From November to January, the current sets in a southerly direction along
25 the east coast, turning, south of the island, into the general westerly monsoon current. In February and March, the westerly set south of the island persists, but northward of about lat. 8° N., the current runs north-westward and northward along the east coast of the island from February to April, forming part of the clockwise circulation of the
30 Bay of Bengal during these months. From May to October, the set along the east coast of Ceylon is southward and south-eastward, turning into the general easterly monsoon current which flows south of the island.

- At Little Basses reef, the change from easterly monsoon current to
35 westerly monsoon current takes place about the middle of October; this reversal is completed along the south coast of the island towards the end of that month. The change from the westerly to the easterly current is more gradual, April being the transition month when currents in both directions occur.

- 40 The region of the east coast of Ceylon, south of about lat. 8° N., and that of the south coast, are noted for strong currents. Off the east and south-east coasts the strongest currents occur in August to December, but principally in October to December. Observations made at the former light-vessel in the vicinity of Little Basses reef in
45 1869 showed south-south-westerly currents of 5 knots in the latter half of October, 4-5 knots in November and 5 knots in December. In October 1947, H.M.S. *Norfolk* recorded a current slightly exceeding 4 knots between lat. 6° 20' N., long. 81° 48' E. and lat. 8° 32' N., long. 81° 23' E. The greatest rates observed on the shipping tracks
50 during the period 1910 to 1931 between the east coast of Ceylon and long. 84° E. were 93 miles per day, in an 062° direction, in lat. 7° 22' N., long. 83° 28' E., in August 1923, and 88 miles per day, in a 201° direction, in lat. 7° 45' N., long. 82° 26' E., in December 1924. A number of other currents observed during this period ranged from
55 3 to 3½ knots.

Southward of Ceylon currents of between 2 and 3 knots are occasion-

Chart 830.

ally met throughout the year, but more particularly in November and December.

The currents off the west coast are less well known than those off the east and south coasts. During the South-west monsoon a strong current, which frequently attains rates of 5-6 knots, sets northward through Pamban pass into Palk strait. During the North-east monsoon there is a southerly set through Pamban pass.

Effect of a tropical revolving storm on the current.—In the vicinity of a tropical revolving storm, the set and drift of the current may be markedly different from that normally to be expected. Comparatively little is known about such currents, particularly near the centre of the storm, since navigators avoid the centre whenever possible, and conditions within the storm field generally are unfavourable to the accurate observation of the current.

The primary cause of the currents is the strong wind associated with the storm. The strength of current produced by a given force of wind varies with the latitude and is greatest in low latitudes. For the latitudes of tropical storms, say 15° to 25° , a wind of force 10 would produce a current of about one knot. It is believed that the strength of the currents of tropical storms is, on the average, the same as that which a wind of similar force, unconnected with a tropical revolving storm, would produce. These currents, at the surface of the water, set at an angle of 45° to the right of the wind direction (in the northern hemisphere) and therefore flow obliquely outward from the storm field, though not radially from the centre.

Unless due allowance is made for these sets, very serious errors in reckoning may therefore arise. It is reported that, in one case, a vessel experienced a south-easterly set of more than 50 miles, under conditions when the set normally to be expected was south-westerly. In another case, an unexpected south-south-westerly set of 60 miles was experienced in 18 hours. These are examples of currents of abnormal strength, which are occasionally met in the vicinity of tropical revolving storms, and which cannot be accounted for by the wind strength. The possibility of such an experience should be borne in mind, particularly near, say within 100 miles, of the centre of the storm.

Other currents, not caused directly by the wind, may flow in connection with these storms but are probably weak and therefore negligible in comparison with the wind current.

The above remarks apply to the open ocean. When a tropical storm approaches or crosses an extended coastline, such as that of Florida, a strong gradient current parallel to the coast will be produced by the piling up of water against the coast. The sea level may rise by as much as from 8 to 15 feet (2^m4 to 4^m6) on such an occasion.

Whether the storm is in the open ocean or not there is a rise of sea level inwards to its centre which compensates for the reduction of atmospheric pressure. The extent of this rise is never great, from one to 2 feet according to the intensity of the storm. It produces no current so long as the storm is not changing in intensity. If the storm meets the coast, however, the accumulation of water at its centre will enhance the rise of sea level at the coast mentioned above and so produce a stronger gradient current along the coast.

TIDES.—The tides in the Bay of Bengal are greatly affected by diurnal inequality, both of time and height.

Chart 829.

BORES.—Bores occur in the entrances to the rivers on the northern and eastern shores of the Bay of Bengal. The best known of these bores are those of the Hooghly, Meghna, Pegu and, especially, Sittang river. No accurate observations have been made of the bores, but they occur at spring tides during the South-west monsoon and may also occur at greater than average spring tides during the North-east monsoon.

SIGNALS.—Storm signals.—The system of storm warnings at 10 ports included in this volume may be briefly described as consisting of :—

- (1) *a General System* of eleven signals, two of which indicate the existence of distant disturbed weather ; eight indicate that local bad weather threatens the port ; and the remaining one indicates that communication with the Meteorological office concerned has broken down and that, in the opinion of the local officer, there is danger of bad weather.
 - (2) *a Brief System*, consisting of five only of the above signals. This system is used at ports frequented mainly by smaller vessels engaged in local traffic.
 - (3) *an Extended System*, which, in addition to the signals of the General System, includes signals to indicate the position of the disturbance. This system is in use only at certain ports in the Bay of Bengal.
- The Madras Meteorological Office is the warning centre for ports on the western shore of the Bay of Bengal southward of, and including, Bāruva, and the Calcutta Meteorological Office for Indian ports northward and eastward of Bāruva and ports in East Pakistan ; Rangoon Meteorological Office is the warning centre for Burmese ports. These authorities keep the Port Officers informed of all necessary warnings and the latest information with respect to disturbances in the seas off the shores of the Bay of Bengal. Ships' officers may therefore apply to the Port Officers for details to supplement the indications of the signals displayed ; they will also receive detailed information in the broadcast weather bulletins issued by the Meteorological Offices through the coastal radio stations.

I.—GENERAL SYSTEM

(a) **Distant signals.**—These indicate that vessels may be exposed to danger after they have left the harbour.

But, if in addition to such distant warnings, there is risk of the port experiencing bad weather, the appropriate local signals are shown in preference to distant signals. For instance, if a port is threatened by squally weather, although the storm centre is far away from it, the Local Cautionary signal, III, will be shown instead of the Distant Warning signal, II. In general, if the weather situation warrants either of two or three signals, then the highest-numbered signal will be shown.

Signification.

Cautionary. There is a region of squally weather in which a storm may be forming.

No. of signal	Day	Night	Signification.
I			This signal is shown at ports so situated with reference to the disturbed weather that a ship leaving the port might run into danger during its voyage. 5 If one of the later mentioned signals is not more appropriate and has not already been shown, this signal is shown at ports on the West coast of India also when a disturbance from the Bay of Bengal is crossing the peninsula and 10 may develop into a cyclone after entering the Arabian sea.
II			<i>Warning.</i> A storm has formed. <i>Note.</i> —This signal is shown when there is no immediate danger of the port itself being affected, but ships 15 leaving the port might run into the storm.
III			(b) Local signals. These indicate that the port itself and the ships in it are 20 threatened. <i>Cautionary.</i> The port is threatened by squally weather.
IV			<i>Warning.</i> The port is threatened by a storm, but it does not appear 25 that the danger is as yet sufficiently great to justify extreme measures of precaution. <i>Note.</i> —The existence of a storm can often be determined before its 30 direction of motion can be fixed. In this case all those ports which the storm could possibly strike are warned by this signal.
V			<i>Danger.</i> The port will experience 35 severe weather from a storm, of slight or moderate intensity, that is expected to cross the coast southward of the port (or eastward in the case of Veraval, ports on 40 the Hooghly, at Diamond island, Bassein, Rangoon and Port Blair).
VI			<i>Danger.</i> The port will experience severe weather from a storm, of slight or moderate intensity, that 45 is expected to cross the coast northward of the port (or westward in the case of ports on the Hooghly, at Chittagong, Rangoon, Moulmein, Karachi and Port Blair). 50

No. of signal	Day	Night	Signification.
5 VII			<i>Danger.</i> The port will experience severe weather from a storm, of slight or moderate intensity, that is expected to cross over or near the port.
10 VIII			<i>Great danger.</i> The port will experience severe weather from a storm of great intensity that is expected to cross the coast southward of the port (or eastward in the case of Veraval, the ports on the Hooghly, at Diamond island, Bassein, Rangoon and Port Blair).
20 IX			<i>Great danger.</i> The port will experience severe weather from a storm of great intensity that is expected to cross the coast northward of the port (or westward in the case of ports on the Hooghly, at Chittagong, Rangoon, Moulmein, Karachi and Port Blair).
25 X			<i>Great danger.</i> The port will experience severe weather from a storm of great intensity that is expected to cross over or near the port.
30 XI			<i>Failure of communications.</i> Communications with the Meteorological warning centre have broken down, and the local officer considers that there is danger of bad weather. The General system is in force at Port Blair, *Mergui, *Moulmein, Cox's Bāzār, Calcutta, Budge Budge, Diamond harbour, Gopālpur, Calingapatam, Bimlipatam, Vizagapatam, Pamban, and Tuticorin. *Tavoy and Sandheads receive information of this system but show no signals. *Storm warnings are issued to these ports from Rangoon.
40			

II.—BRIEF SYSTEM

In the Brief system only one of the five following signals is shown, and the Port Officers are kept informed of the prospects of local bad weather associated with any disturbance in the sea, for the general information of shipping. 5

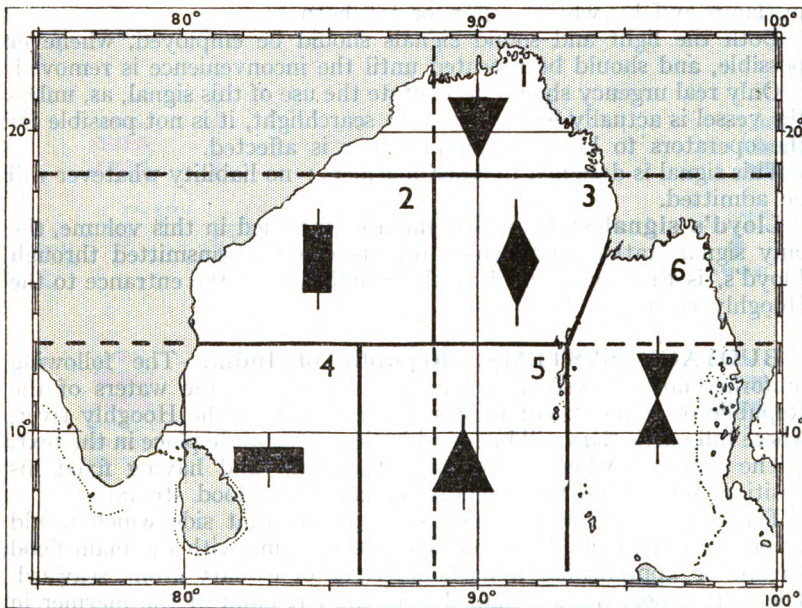
Signal No. III.—Cautionary	} Meaning the same as day and night signals in the General system. 10
Signal No. IV.—Warning	
Signal No. VII.—Danger	
Signal No. X.—Great Danger	
Signal No. XI.—Failure of communications	

This system is in force at Chandbali, Puri, Baruva, and Masulipatam. *Kyaukpyu and Mandapam receive information of this system but show no signals. *Storm warnings are issued to this 15 port from Rangoon.

III.—EXTENDED SYSTEM

An Extended system (additional daily signals for the Bay of Bengal). In the Bay of Bengal it is possible to locate the area of bad weather with some degree of certainty, even though the disturbance may be 20 far from the coast.

In order to give daily information to a port regarding weather in the Bay of Bengal, the bay is divided into six sections, as shown on the chartlet below.



At ports not threatened, a "section" signal for the area affected, as indicated on the chartlet, is shown under the "Distant cautionary" 25 or "Distant warning" signals (see page 31) to indicate the position of the disturbance in the Bay of Bengal.

Thus, if there is squally weather in Section V of the bay the signal, a cylinder placed horizontally over a cone, point upwards, would be shown at the various ports.

If a storm has formed in Section II the signal, two cylinders disposed vertically, would be shown at all the ports which were not directly threatened. The ports threatened would show one or the other of the local signals.

If the port itself is threatened only the appropriate "Local" signals of the General system would be shown.

- 10 If the centre of the storm is near the boundary of a section, two locality signals will be given, the first indicating the section in which the centre is supposed to be, and the second the neighbouring section near to which it is. In the event of a storm centre being near to the angles where three sections meet, three locality signals will be shown.
- 15 The first will give the section in which the storm is supposed to be, the second the nearest adjoining section, the third the remaining section.

This system is in force at *Rangoon, *Diamond island, *Akyab, Chittagong, Sagar island, Cocanada, Madras, Cuddalore, Porto Novo, and Negapatam. *Bassein of this system receives information but shows no signals. *Storm warnings are issued to these ports from Rangoon.

These signals are also shown at Sabang, Pulau Wé, off the north-western end of Sumatra.

- 25 **Signal to be made by vessels when inconvenienced by search-lights.**—In the event of the navigation of a vessel being inconvenienced by the glare from searchlights near a port in the British Empire, she should make the International code signal ZO (— — . . — — —) by lamp and by whistle, siren or fog horn.

- 30 Both the light and sound signals should be employed, whenever possible, and should be repeated until the inconvenience is removed.

Only real urgency should necessitate the use of this signal, as, unless the vessel is actually in the rays of a searchlight, it is not possible for the operators to know which projector is affected.

- 35 This signal is designed to assist mariners; no liability whatever will be admitted.

Lloyd's signal station.—In the area included in this volume, the only signal station from which reports can be transmitted through Lloyd's, is that maintained at the Sandheads at the entrance to the Hooghly river.

BUOYAGE SYSTEMS.—Republic of India.—The following uniform buoyage system is generally adopted in the waters of the Republic of India except in special areas such as the Hooghly river, where full particulars will be found in the appropriate place in the text.

- 45 The mariner, when approaching the coast and having fixed his position, must note the direction of the main flood stream.

The term "starboard hand" shall denote that side which would be on the right hand of the mariner either going with the main flood stream or approaching a harbour, river or estuary from seaward.

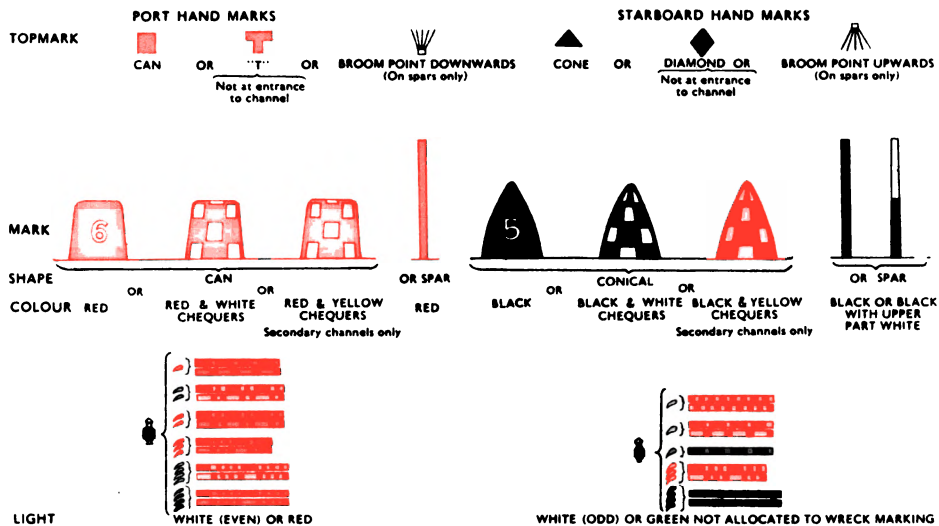
- 50 The term "port hand" shall denote the left hand of the mariner in the same circumstances.

Buoys marking the same side of a channel, estuary or tide way may be distinguished from each other by names or by consecutive letters or numbers, commencing from seaward, odd numbers to starboard, even

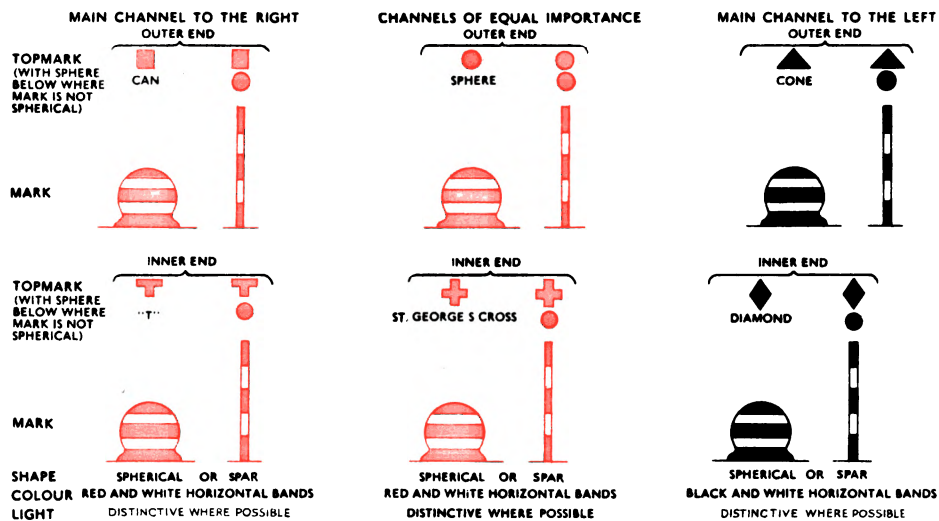
- 55 to port.

DIAGRAMS ILLUSTRATING THE UNIFORM SYSTEM OF BUOYAGE

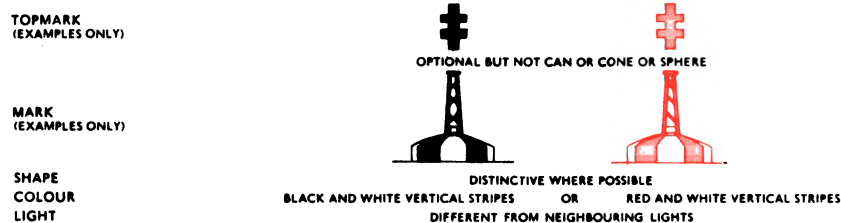
LATERAL SYSTEM



MIDDLE-GROUND OR BIFURCATION OR JUNCTION MARKS



MID-CHANNEL MARKS



CARDINAL SYSTEM



**NOTE. SLIGHT MODIFICATIONS IN MINOR DETAILS TO THE ABOVE
HAVE BEEN INTRODUCED BY CERTAIN COUNTRIES**

DIAGRAMS ILLUSTRATING THE UNIFORM SYSTEM OF BUOYAGE

MARKS COMMON TO BOTH SYSTEMS

AND OTHER MARKS

ISOLATED DANGER MARKS

TOPMARK



MARK



SHAPE

SPHERICAL OR SPAR

COLOUR

WIDE BLACK AND RED HORIZONTAL BANDS
SEPARATED IF DESIRABLE BY A NARROW WHITE BAND

LIGHT

FLASHING (WHITE OR RED)

FAIRWAY MARKS



OPTIONAL (SEE FOOTNOTE)

BLACK AND WHITE VERTICAL STRIPES OR RED AND WHITE VERTICAL STRIPES

FLASHING

TRANSITION MARKS

TOPMARK



MARK



SHAPE

OPTIONAL (SEE FOOTNOTE)

COLOUR

RED AND WHITE DIAGONAL STRIPES OR BLACK AND WHITE DIAGONAL STRIPES

QUARANTINE-GROUND MARKS



OPTIONAL (SEE FOOTNOTE)

YELLOW

OUTFALL AND SPOIL-GROUND MARKS

MARK



SHAPE

OPTIONAL (SEE FOOTNOTE)

COLOUR

YELLOW ABOVE AND BLACK BELOW

AREAS USED FOR NAVAL MILITARY OR AIR FORCE PRACTICE PURPOSES



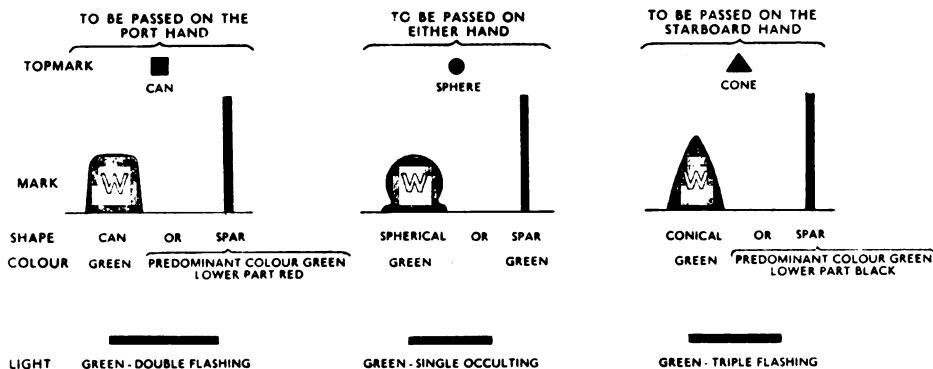
OPTIONAL (SEE FOOTNOTE)

WHITE WITH BLUE CROSS

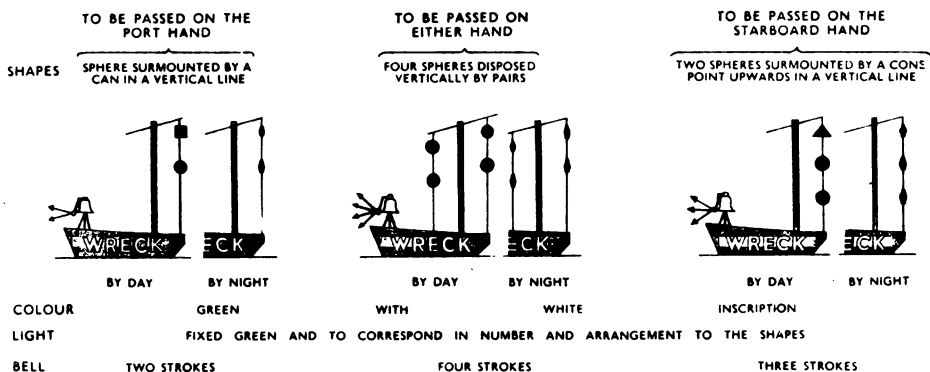
FOOTNOTE: SHAPE IS OPTIONAL AND THE ILLUSTRATIONS ARE TO BE REGARDED AS EXAMPLES ONLY
THE ONLY DEFINITE REQUIREMENT IS THAT THE SHAPE ADOPTED SHALL NOT BE MISLEADING

DIAGRAMS ILLUSTRATING THE UNIFORM SYSTEM OF BUOYAGE MARKING OF WRECKS

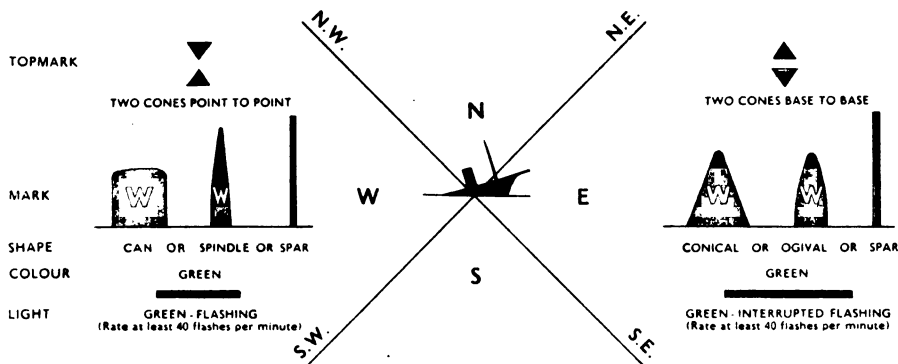
LATERAL SYSTEM BUOYS



VESSELS



CARDINAL SYSTEM



Starboard hand buoys.—Starboard hand buoys are conical in shape and are painted black or black and white in chequers. The topmark (if any) is a black cone, or, for purposes of differentiation except at the entrance to a channel, a black diamond. If lit, a *white flashing* light, having *one, three or five* flashes, is exhibited. 5

Port hand buoys.—Port hand buoys are can shaped and are painted red or red and white in chequers. The topmark (if any) is a red can or, for purposes of differentiation except at the entrance to a channel, a red **T**. If lit, a *red flashing* light, having *any number* of flashes *up to four* or a *white flashing* light having *two, four or six* flashes, 10 is exhibited.

Middle ground buoys.—Middle ground buoys are spherical in shape ; if the main channel lies to starboard or if the channels are of equal importance, they are painted in red and white horizontal bands ; if the main channel lies to port they are painted in black and white 15 horizontal bands. When topmarks are carried, if the main channel lies to starboard, the outer end buoy is distinguished by a red can and the inner end buoy by a red **T** ; if the main channel lies to port, the outer end buoy is distinguished by a black cone and the inner end buoy by a black diamond ; if the channels are of equal importance, the outer 20 end buoy is distinguished by a red sphere and the inner end buoy by a red St. George's cross. If lit, their lights are either *white or red* and are distinctive as far as possible ; neither the colour nor the phase of the light is such as to lead to uncertainty as to the side of which the buoy must be passed. 25

Mid-channel buoys.—Mid-channel buoys are distinctive in shape, being neither conical, can, nor spherical ; they are painted in black and white, or in red and white, vertical stripes. If a topmark is carried it is distinctive in shape, being neither cone, can, nor sphere ; if lit, their lights differ from other lights in the vicinity. 30

Isolated danger buoys.—Buoys marking isolated dangers are spherical in shape and are painted in wide black and red horizontal bands which are separated by a narrow white band. If a topmark is carried it consists of a sphere painted black or red, or half black and half red horizontally ; if lit, they exhibit *white or red flashing* 35 lights.

Landfall or Fairway buoys.—These buoys are similar in shape and colour to those which may be used for marking mid-channels (*see above*) ; if lit, they will exhibit *flashing* lights.

Miscellaneous buoys.—Buoys marking spoil grounds or sewer 40 outfalls are not considered as navigational buoys and are generally conical, painted horizontally, the upper half yellow and the lower half black.

Buoys intended for moorings, or other purposes not included above, may be of any shape or colour, according to the discretion of the 45 authority within whose jurisdiction they are laid, but not such as might lead to confusion with buoys whose purpose is defined above.

Buoys fitted with sound signal devices will have, if practicable, the characteristics appropriate to their position in accordance with the foregoing rules. 50

Caution.—In certain cases slight modification to the above rules may be found where local circumstances make it desirable. Full particulars will be found in the appropriate place in the body of this book, which should invariably be consulted.

Buoyage diagrams.—The four coloured plates facing pages 34 55 and 35 illustrate the Uniform System of Buoyage as agreed at the

London Conferences of 1933 and 1936. The above article gives details of this system as applied by the Indian authorities.

Pakistan.—In the waters under the jurisdiction of the Pakistani authorities, starboard hand buoys are conical, painted red, and if 5 lighted, exhibit *red* lights. Port hand buoys are can-shaped, painted black or parti-coloured, and if lighted, exhibit *green* lights.

The topmarks of middle ground buoys are spheres on the outer marks and half-spheres, round part uppermost, on the inner marks.

Ceylon.—The Uniform System of Buoyage of 1936 is in force in 10 the waters under the jurisdiction of the Government of Ceylon.

Burma.—There is no recognised system of buoyage in use in Burmese waters.

Wreck marks.—Throughout the area covered by this volume, the Uniform Lateral system of wreck-marking (*see* buoyage diagrams) is 15 in force, unless the Authorities having jurisdiction in a particular locality, in their discretion, determine otherwise.

It should, however, be noted, that in Pakistani waters, *green* lights may be used on buoys other than those marking wrecks.

LIFE-SAVING.—Lifeboats and Life-saving appliances form the 20 principal means adopted for saving life; the stations where these are maintained are listed hereafter and are mentioned in their appropriate places in this volume.

The line-throwing apparatus, the principal life-saving appliance, can often be used with effect when a lifeboat is not available; its 25 success, however, depends largely upon an intelligent co-operation on the part of the crew of the stranded vessel.

Signals.—In accordance with the International Convention for the Safety of Life at Sea, 1948, Chapter V, Regulation 16, the following signals shall be used by life-saving stations when communicating with 30 ships in distress and by ships in distress when communicating with life-saving stations :—

(a) *Replies from shore station to distress signals made by a ship :—*

Signal	Signification
By day.—White smoke signal.	} “ You are seen—assistance will be given as soon as possible.”
35 By night.—White star rocket.	

(b) *Landing signals for the guidance of small boats bringing away the crew of a wrecked ship :—*

Signal	Signification
(i) By day.—Vertical motion of a white flag or the arms.	} “ This is the best place to land.”
40 By night.—Vertical motion of a white light or flare. A range (indication of direction) may be given by placing a steady white light or	
45 flare lower and in line with the observer.	} “ Landing here highly dangerous.”
(ii) By day.—Horizontal motion of a white flag or arms extended horizontally.	
50 By night.—Horizontal motion of a white light or flare.	

Signal	Signification
(iii) <i>By day</i> .—Horizontal motion of a white flag, followed by the placing of the white flag in the ground and the carrying of another white flag in the direction to be indicated.	"Landing here highly dangerous. A more favourable location to land is in the direction indicated."
<i>By night</i> .—Horizontal motion of a white light or flare, followed by the placing of the white light or flare on the ground and the carrying of another white light or flare in the direction to be indicated.	

(c) *Signals to be employed in connection with the use of shore life-saving apparatus :—*

Signal	Signification	
(i) <i>By day</i> .—Vertical motion of a white flag or the arms. <i>By night</i> .—Vertical motion of a white light or flare.	<i>In general</i> :—"Affirmative."	15
	<i>Specifically</i> :—	
	"Rocket line is held."	
	"Tail block is made fast."	20
	"Hawser is made fast."	
(ii) <i>By day</i> .—Horizontal motion of a white flag or arms extended horizontally. <i>By night</i> .—Horizontal motion of a white light or flare.	"Man is in the breeches buoy."	
	"Haul away."	
	<i>In general</i> :—"Negative."	
	<i>Specifically</i> :—	25
	"Slack away."	
	"Avast hauling."	

Life-saving stations.—Lifeboats are maintained at the following places in the area covered by this volume :—

Colombo.—3 Power lifeboats and 3 Tugs.	
Galle :—2 Pulling lifeboats and one Power lifeboat.	30
Batticaloa :—One Power lifeboat.	
Trincomalee :—3 Power lifeboats.	
Jaffna :—One Power lifeboat.	

STANDARD AND SUMMER TIMES.—All information regarding Standard Times and Summer Times will be found in the Admiralty List of Radio Signals, Vol. II.

AIR LIGHTS.—Mariners are warned that lights (with definite characteristics), which are not ordinary navigational aids, may be exhibited for the use of aircraft from structures near the coasts described in this volume.

These lights are often of great luminous power and altitude and may be the first lights or looms of lights sighted when making a landfall at night ; they normally have the following characteristics :—

- (a) *Flashing white* (revolving beam type).
(These lights are usually screened from seaward but their looms may be visible.) 45
- or (b) *Alternating flashing white and green* (revolving beam type).
- or (c) *Flashing two letter groups* in the Morse Code in *red* or *green*.
(Although the groups made by these lights may have definite meanings in the International Code of Signals, their signification is to be disregarded ; the fact that they are *red* or 50

green in colour, and flash with mechanical regularity, should prevent their being mistaken for signals from shore signal stations or ships.)

Air lights which appear likely to be visible from seaward will be shown on charts and described in the Admiralty Lists of Lights. As they are subject to changes of which prompt notification to the mariner may not always be possible, care should be taken that they are not confused with marine navigational aids.

COMMUNICATIONS.—Ceylon.—There is regular sea and air communication between Colombo and all parts of the world.

The principal and many of the smaller towns in Ceylon are connected with the general telegraph and telephone systems.

Republic of India and Dominion of Pakistan.—Details of the sea communications between the various ports are described in the body of this volume.

There is regular air service to all parts of the world from Calcutta and Dacca. Most of the larger cities and towns are connected by internal air routes.

Within the area covered by this volume all the towns and most of the villages are connected with the general telegraph and telephone systems.

Burma.—Details of the sea communications between the various ports are described in the body of this volume.

There is regular air service between Rangoon and all parts of the world.

The principal and many of the smaller towns in Burma are connected with the general telegraph system.

Radio stations.—The following coastal radio stations in the area covered by this volume are open for public correspondence:—

Colombo, Madras, Calcutta, Chittagong, Rangoon, and Port Blair. For details, see List published by the General Secretariat of the International Telecommunication Union.

There are radio direction-finding stations at Calcutta and Chittagong.

For details of radio stations which transmit weather bulletins, storm signals, navigational warnings, time signals, etc., see Admiralty List of Radio Signals.

FUEL.—Coal and fuel oil can be obtained at Colombo, Madras, Calcutta, Chittagong and Rangoon; coal can normally be obtained at Akyab and fuel oil at Jaffna. Small quantities of coal can be obtained at Galle, Pondichéry, Cuddalore, Bassein, Moulmein and Port Blair; small quantities of fuel oil can be obtained at Cocanāda and Mergui.

REPAIRS.—Repairs to hull, engines and boilers can be carried out at Colombo, Madras, Calcutta and Rangoon. There are dry docks at Colombo, Cocanāda, Vizagapatam and Calcutta. There are patent slips at Madras, Chittagong, Akyab, Port Blair, Bassein, Rangoon and Moulmein; the dimensions of the largest dock or patent slip, in each case, are given in Appendix I.

SUBMARINE CABLES.—The following Articles are taken from the International Convention for the protection of Submarine Telegraph cables, of 14th March, 1884.

II. It is a punishable offence to break or injure a submarine cable, wilfully or by culpable negligence, in such manner as might interrupt

or obstruct telegraph communication, either wholly or partially, such punishment being without prejudice to any civil action for damages.

This provision does not apply to cases where those who break or injure a cable do so with the lawful object of saving their lives or their ship, after they have taken every necessary precaution to avoid so breaking or injuring the cable. 5

V. Vessels engaged in laying or repairing submarine cables shall conform to the regulations as to signals which have been, or may be, adopted by mutual agreement among the High Contracting Parties, 10 with a view of preventing collisions at sea.

When a ship engaged in repairing a cable exhibits the said signals, other vessels which see them, or are able to see them, shall withdraw to or keep beyond a distance of one nautical mile at least from the ship in question, so as not to interfere with her operations. 15

Fishing gear and nets shall be kept at the same distance.

Nevertheless, fishing vessels which see, or are able to see, a telegraph-ship exhibiting the said signals, shall be allowed a period of twenty-four hours at most within which to obey the notice so given, during which time they shall not be interfered with in any way. 20

The operations of the telegraph-ships shall be completed as quickly as possible.

VI. Vessels which see, or are able to see, the buoys showing the position of a cable when the latter is being laid, is out of order, or is broken, shall keep beyond a distance of one-quarter of a nautical 25 mile at least from the said buoys.

Fishing nets and gear shall be kept at the same distance.

VII. Owners of ships or vessels who can prove that they have sacrificed an anchor, a net or other fishing gear in order to avoid injuring a submarine cable, shall receive compensation from the owner 30 of the cable.

In order to establish a claim to such compensation, a statement, supported by the evidence of the crew, should, whenever possible, be drawn up immediately after the occurrence; and the master must, within twenty-four hours after his return to or next putting into port, 35 make a declaration to the proper authorities.

The latter shall communicate the information to the Consular authorities of the country to which the owner of the cable belongs.

Caution.—Cautionary notes appear on many charts, calling attention to areas in which there are submarine cables; these areas are 40 indicated by pecked lines.

Every care should be taken to avoid anchoring in such areas, even though there may be no specific prohibition against doing so, in view of the serious interference with communications which results from damage to submarine cables. 45

Equal care should be taken wherever the symbol for a submarine cable (a wavy line) is shown on the chart.

Danger involved in cutting cables to clear anchors or fishing gear.—In the event of any vessel fouling a submarine cable, every effort should be made to clear the anchor or gear by normal methods; should 50 these efforts fail, the anchor or gear should be slipped and abandoned without attempting to cut the cable. High voltages are, or may be, fed into certain submarine cables; serious risk exists of loss of life due to electric shock, or at least of severe burns, if any attempt to cut the cable is made. No claim in respect of injury or damage sustained through such 55 interference with a submarine cable will be entertained.

Compensation for anchors or fishing gear sacrificed in order to avoid injuring a submarine cable can be claimed under the Submarine Telegraph Act, 1885 (Schedule of Submarine Telegraph Convention, Article VII).

- 5 **REGULATIONS.—Quarantine.**—The following regulations are in force for vessels arriving at ports in India, Pakistan and Burma :—

The master of every suspected or infected vessel or of any vessel on which unusual mortality among rats has been observed shall, on arrival at any port, hoist the appropriate quarantine signals prescribed in the International Code of Signals.

Vessels arriving at ports in Burma, should, on arrival, obtain a copy of Notification of the Public Health Branch of the Education Department, published at Rangoon on the 10th of August, 1938. The following are extracts therefrom :—

- 15 Without permission from the Health Officer, there must be no communication between any infected or suspected vessel and the shore, any other vessel or boat, except to receive the pilot, Customs officers and assistant harbour masters.

Until pratique is granted, such vessels must remain at the special anchorage allotted and continue to show the prescribed signal. The master of every such vessel shall permit the Health Officer or his deputy to examine medically the passengers and crew of the vessel and shall render every assistance in his power for the carrying out of such inspection.

- 25 Vessels having cholera, yellow fever or plague on board when within the 3-mile limit of the coasts of Ceylon, must make the signals as directed on page 98.

For signals to be made by vessels arriving at ports in India and Pakistan, *see* quarantine regulations above.

- 30 **Deratisation.**—In accordance with Article 28 of the International Sanitary Convention of 21st June, 1926, deratisation can be carried out and deratisation exemption certificates can be issued to vessels at the following ports :—Calcutta, Rangoon.

Regulations for visiting or trading at Andaman and Nicobar islands.—Vessels are not allowed to visit Port Blair for commercial purposes, except under Government contracts.

In order to visit and trade at the Nicobars a permit must be obtained from Port Blair.

- Regulations for approaching French territorial waters in time of war.**—Decree of 1st October, 1934.

1. In time of war, the conditions under which vessels, other than French vessels of war may enter and remain in anchorages and ports of France, her colonies, protectorates and mandated territories, are governed by the following regulations.

- 45 2. No French merchant vessel, nor any foreign man-of-war or merchant vessel may approach within 3 miles of the coast in the territorial waters of France, her colonies, protectorates or mandated territories, without permission except at the risk of being destroyed.

3. Every vessel affected by the present decree must display her national flag on approaching the prohibited zone, and also her International Code number ; at night she must show her navigation lights.

If desirous of entering the prohibited zone in order to reach a port, permission must be asked as follows :—

- 55 By day, by displaying the pilot flag (G flag of the International

Code of Signals), accompanied, if possible, by the International Code signal PT (I require a pilot) signalled in Morse code by searchlight.

By night by making in Morse code the signal PT, followed by her International Code number, or, if she has no means of doing this, by making the night signal for a pilot in accordance with the International Code of Signals, viz., a *white* light flashed or shown just above the bulwarks at short or frequent intervals for *about a minute* at a time, accompanied if necessary by a *blue* light *every fifteen minutes*.

The vessel must remain outside the zone until she has received a reply from a signal station or from an examination vessel.

The reply by semaphore or from the examination vessel is made as follows :—

Entry permitted :—

By day, by searchlight, "UI" in Morse code repeated three times, or flags "UI" of the International Code of Signals.

By night, by searchlight, or flashing light, "UI" in Morse code repeated three times, or by a *white* Very's light.

Entry forbidden :—

By day, by searchlight, "UJ" in Morse code repeated three times, or flags "UJ" of the International Code of Signals.

By night, by searchlight or flashing light, "UJ" in Morse code repeated three times, or by a *red-green* Very's light.

If permission is granted, the vessel must enter the prohibited zone at reduced speed, displaying by day flag G of the International Code of Signals, and by night exhibiting her navigation lights and must steer for the examination vessel. The latter has normally no distinguishing marks, but if she wishes to show vessels in sight that she is engaged on examination duties, she displays at the masthead a black ball by day and exhibits a *red* light at night, or, alternatively, "MAJ" in Morse code three times by flashing light. If entry be refused, the visiting vessel must immediately alter course and proceed for some other anchorage.

Article 4 relates to certain prohibited zones, none of which are in the area included in this volume.

5. In foggy weather, every vessel affected by the present decree, desirous of entering the forbidden zone is to display the same signals as in clear weather, and sound blasts on the siren or whistle until permission to enter has been given by an examination vessel.

6. Every vessel affected by the present decree must immediately comply with the orders of a vessel of war or an examination vessel, or a signal station. These are given either by a warning gun or by a signal of the International Code of Signals.

Any vessel warned by a battery or vessel of war must immediately alter course by more than eight points (90°) and steer so that she remains in sight of signals from the vessel of war or signal station nearest to the battery that challenged her. She may not proceed on her former course until authorised to do so.

If the vessel does not alter course after a blank charge has been fired to warn her, a live shell will be fired a few minutes later, and, if a vessel does not immediately conform to this order, effective fire will be opened on her.

In urgent cases the warning by the firing of a blank charge may be omitted.

At night the warning shot with live shell may also be omitted,

and any vessel entering the prohibited zone without permission is liable to be destroyed without preliminary warning.

7. Vessels authorised to enter roads and ports in France, or in the French colonies, protectorates or mandated territories, must keep strictly within the approach channel.

For this purpose they will be piloted by a vessel set apart for this duty. Should a port have no pilotage vessel, the examination vessel will send a pilot on board the visiting vessel.

Vessels must take up the berths assigned to them and conform strictly to the special regulations in force.

The length of stay of a vessel will depend on military considerations, and, when circumstances require it, a vessel may be ordered to put to sea, or to move to a determined point ; such order must be carried out without delay, though respite may be allowed to vessels really unable to conform to it immediately.

No vessel is to get under way, either to shift berth or to quit the anchorage, without the permission of the local authority ; a request may be made by signal, displaying G flag of the International Code of Signals.

8. In naval roads and ports, between sunset and sunrise, the movement of boats other than those of French vessels of war is absolutely forbidden.

From sunrise to sunset movement is only allowed to boats which have received a special permit from the naval authorities and the means of making themselves recognisable. Boats with permits should keep clear of vessels of war if ordered to do so, and cannot in any case go alongside the latter without their permission. The movements of these boats will, moreover, remain subject to local regulations, notably those relative to the prohibition to enter certain parts of the roadstead, and to go alongside any place other than those expressly notified.

In commercial ports similar measures will be taken by the local authority to impose the restrictions considered necessary on the movements of boats, due regard being given to the interests of commerce.

9. Visits by neutral vessels of war are governed in time of war as in time of peace by the decree of 29th September, 1929, so far as notification or previous authorisation is concerned.

10. The measures provided for by the present decree are to come into force on mobilisation or on special notice.

11. Any infraction of the above regulations will lead to such repressive measures as the circumstances admit of, in addition to the risks of destruction incurred.

Law on navigation in Thailand waters.—Every master of a ship shall display her colours on entering Thailand waters, and shall keep such colours flying during daylight until the ship shall have been boarded by the Harbour master.

The master of every vessel entering or going out of any port or river of the kingdom of Thailand shall cast anchor at the guard station of such port or river, report his arrival or departure to the officer of the station, and follow the instructions which such officer shall give him.

A copy of the "Law on Navigation in Thailand Waters" shall be handed to the master of every vessel entering a harbour in case he has not already been provided with the same.

BRITISH CONSULAR OFFICERS.—A British Consular officer resides at Pondichéry and at Rangoon.

Chart 829.

MUD VOLCANOES.—A particular feature of the Arakan coast of Burma is the number of mud volcanoes discharging marsh gas and sometimes flames, which occur, not only on the mainland and the islands adjacent to it, but also in the sea in their vicinity; these latter constitute a serious danger to navigation, as they apparently happen in any part, although certain areas, probably governed by local lines of fault, seem to be more liable to them than others; of these, the neighbourhood of the Terribles and Cheduba island may be mentioned.

Mud volcanoes, which occur in the sea, frequently raise islets, which may remain above water for some time, or quickly sink, leaving dangerous shoals in their places, and a constant and careful lookout is necessary when navigating this coast.

An active mud volcano, with two summits, appeared at a distance of about 8 miles southward of Boronga point; this volcano, on the 1st May, 1914, was about 30 feet (9^m1) in height, and about one cable in extent; on the 14th November, 1923, this volcanic islet was reported to be from 20 to 30 feet (6^m1 to 9^m1) high, and about 1½ cables in extent, but in March, 1924, it had disappeared and an area of shoal water existed in its former position and for a distance of 2½ miles westward of it.

CLIMATE AND WEATHER. — General conditions. — The weather in the Bay of Bengal and on its shores is mainly governed by the monsoons.

From about June to September the very damp warm South-west monsoon blows, often with considerable strength, and there are long periods of cloud and heavy rain, especially on those coasts exposed to the monsoon. In these wet periods a destructive cyclone (*see* Cyclones, page 48) sometimes develops, but such a storm is more likely during the transition seasons before and after the South-west monsoon (May and October-November). It is important to remember, however, that a long period of years normally elapses between successive occasions on which any one point in the Bay is affected by a destructive cyclone.

From November to February is the main season for the North-east monsoon, which is generally dry over most of the Bay, especially in the north, where fine weather with clear skies is usual; southward of Madras, however, coasts exposed to this monsoon have considerable rain.

In the hot months, from March or April to June, very high temperatures are experienced on many coasts; there are many sunny days, but severe squalls and thunderstorms may occur.

On some coasts considerable fog develops at night during periods when there is little cloud and wind.

Pressure.—The seasonal changes in the distribution of pressure over the Bay of Bengal are very marked (*see* Figures 1–4). In the northern winter, over the land to the northward and north-westward, pressure is high, and over the Bay average pressure decreases southward. For example, the average pressure for January is 1017 mb. at Calcutta, 1016 mb. at Madras and 1011 mb. at Colombo. In the northern summer, on the other hand, pressure is very low over northern India, and over the Bay of Bengal average pressure increases southward. Thus, the average for July increases from 1000 mb. at Calcutta to 1009 mb. at Colombo. This increase of average pressure southward

is maintained until September. In September or October, pressure commences to rise rapidly over the continent of Asia, and by November the winter distribution of a steady decrease of pressure southward over the Bay has become established. Average values of the pressure for each month are given for a number of ports in the climatic tables on pages 70 to 86.

Generally, changes of pressure in the Bay are small and take place slowly, and, as a rule, the most conspicuous change is the diurnal variation, which is described later.

- 10 The chief disturbances which are likely to affect the pressure in the Bay of Bengal are tropical cyclones, which are described on page 48. These storms may occur at any time of the year, but they are most likely between May and November: they are rare from January to March. When forecasting the development or approach of a cyclone from the changes of pressure (*see* standard article on "Tropical Revolving Storms," page xxxiv), allowance should be made for the diurnal variation as follows:—

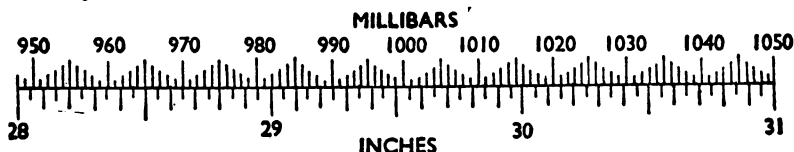
Corrections in millibars and tenths of a millibar to be applied for diurnal variation over the sea within the area covered by this volume.

November to April												
Local time	Midt.	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
	-0.2	+0.2	+0.6	+0.9	+0.9	+0.6	+0.1	-0.5	-1.1	-1.5	-1.7	-1.4
Local time	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
	-0.9	-0.2	+0.5	+1.1	+1.4	+1.3	+1.0	+0.5	0.0	-0.4	-0.6	-0.5
May to October												
Local time	Midt.	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
	-0.4	-0.1	+0.3	+0.5	+0.6	+0.4	+0.1	-0.4	-0.9	-1.2	-1.3	-1.1
Local time	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
	-0.7	-0.1	+0.5	+1.0	+1.3	+1.3	+1.0	+0.6	+0.1	-0.3	-0.6	-0.6

- 20 The above corrections can be used for coastal positions as well as for the open sea, although diurnal variation is slightly larger in most months over most of the coastline.

Another type of disturbance which sometimes affects the head of the Bay is the "Western depression." These depressions travel across India from the west during the cool season (*see* under "Western depressions," page 57).

The following diagram gives the equivalent in millibars of inches of mercury.



- 30 **Winds.**—For detailed information about local winds, *see* under "Local Winds," page 59.

Corresponding with the seasonal change in the distribution of pressure over the Bay of Bengal, there is a change in the direction of the prevailing winds. During the northern winter when the average pressure is decreasing southward, the prevailing winds are north-easterly—the North-east monsoon. In the northern summer when the average pressure is increasing southward, the prevailing winds blow from the opposite direction—the South-west monsoon.

- In figures 1-4 on pages 45 and 46, the arrows show the direction of the predominant wind, if its constancy is at least 51% according to the following scheme:—

— — — → 51-60% —————→ 61-80% =====> 81-100%

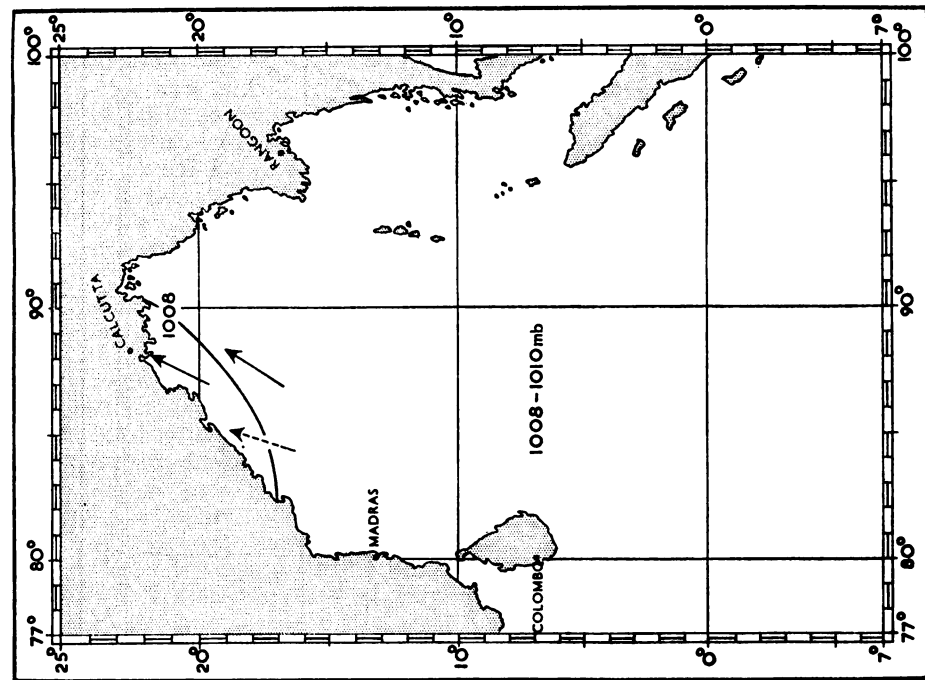


Fig. 2.—April

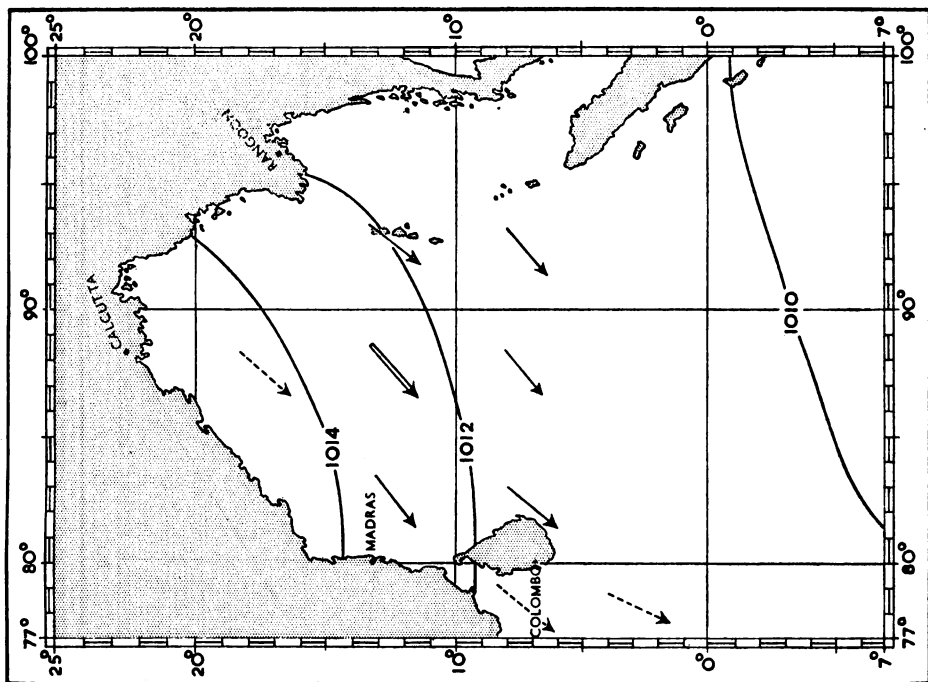


Fig. 1.—January

MEAN PRESSURE AND PREDOMINANT WINDS

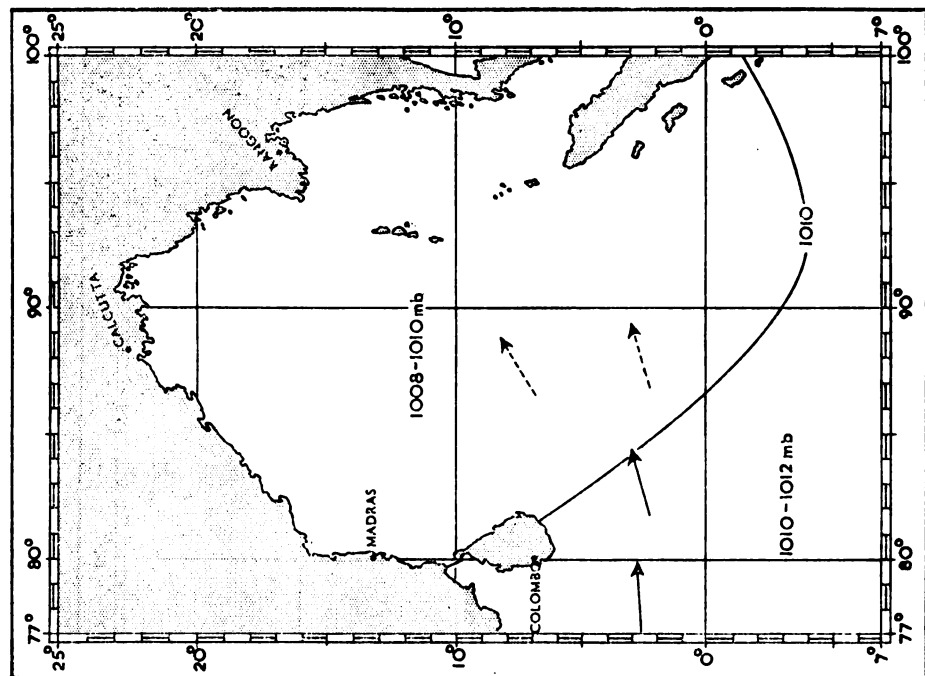


Fig. 4.—October

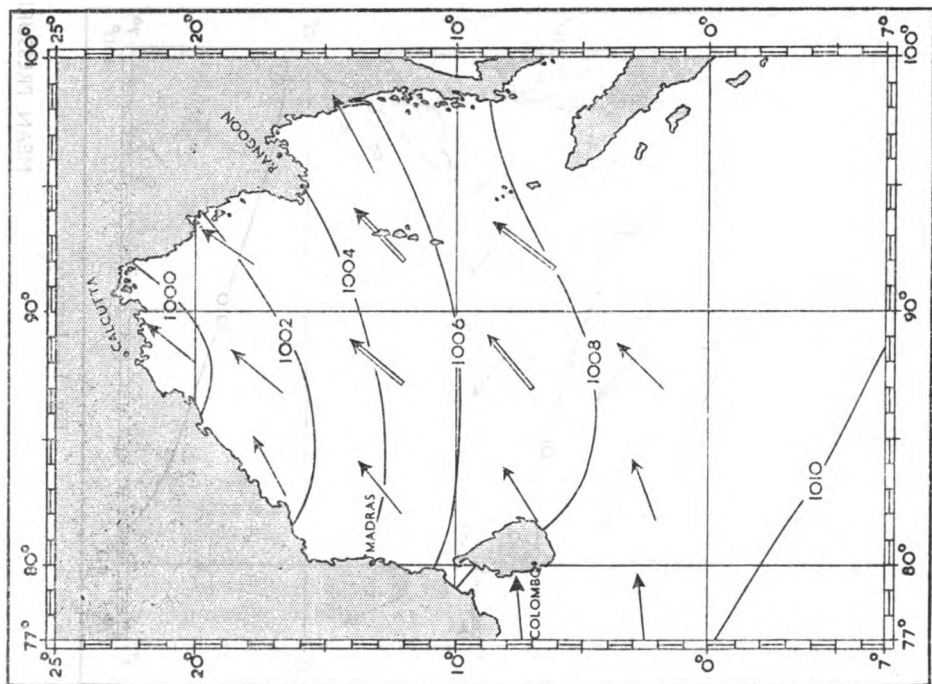


Fig. 3.—July

MEAN PRESSURE AND PREDOMINANT WINDS

Predominance is judged in relation to that quadrant (90°), not necessarily bounded by the four cardinal points, which shows the greatest number of winds. Only winds of force 3 or more are taken into account in estimating predominance. The arrow shows the direction bisecting the quadrant, and the constancy is defined as the percentage relation between the number of winds from that quadrant, of forces 3-12, and the total number of winds observed from all directions (including forces 0-2). 5

The North-east monsoon.—The North-east monsoon begins in the northern part of the Bay in October but is not established until November; in the southern part, it is not generally established until the middle or end of that month. The general direction and strength of the monsoon vary somewhat from one region to another. In December and January, north-easterly winds prevail generally; but at the head of the Bay and southward of about lat. 5° N. the mean direction is more northerly than elsewhere, and winds may blow from directions between north-west and north-east. In March, winds become more easterly in the western part of the Bay and more north-westerly in the eastern part, than in the previous two months. 10 15

At the head of the Bay in February and March, the North-east monsoon becomes increasingly unsteady. In March, southerly and south-westerly winds predominate over the region northward of about lat. 15° N. and westward of long. 90° E., while towards the coasts of Burma and Thailand, the wind is nearly always from some westerly point. Between the Nicobar islands and Ceylon, north-easterly winds still prevail, but they are weaker and less steady than in previous months. 20 25

The strength of the wind in December and January is generally Beaufort force 3 or 4, except near the equator where it is rather lighter. During the 3 months December to February there is a chance that the wind will reach Beaufort force 7, but in most years it does not reach this strength in any of these months. 30

Transition season.—April and May are the months of transition between the North-east and South-west monsoons.

In April, the winds are mainly south-westerly at the head of the Bay and off the Orissa coast, becoming southerly off the Coromandel coast. Off the eastern shore of the Bay they are westerly. They are mainly light or moderate in the above regions. On the other hand, over the area bounded by the parallels of 5° N. and 15° N., and the meridians of 85° E. and 95° E., the winds are variable and mainly light. 40

In May, the general direction over the Bay is south-westerly.

The strength of the wind usually varies between force 3 and 4, but gale force may be reached occasionally. The South-west monsoon, proper, usually begins in the southern part of the Bay during this month with squally weather and heavy rain. 45

Nor'westers (*see* page 57) may be experienced off the coasts of Orissa and West and East Bengal in April and May.

South-west monsoon.—From June to September the South-west monsoon blows over the whole area. It is strongest and steadiest in the central and western parts of the Bay. At the head of the Bay its direction is more southerly, blowing from between south-south-east and south-south-west. In most regions the wind has had a long fetch over the sea and is very humid, bringing heavy rain at times. 50

This monsoon extends northward from the southern part of the Bay during the first half of June, though the time of onset varies from one year to another. At the beginning of the month the weather in the 55

southern part is very squally with heavy rain ; this area of disturbed weather advances northward until the whole Bay is affected. After the monsoon has become fully established, squalls and rain are much less frequent. The average strength of the wind is about force 5 in the south and about force 4 in the north. The strength, however, varies considerably ; the wind may frequently freshen to force 6 or 7, and even forces 9 and 10 have sometimes been reached. At other times the wind moderates and a spell of fair weather may occur for several days at a time. In September, the average strength of the wind decreases somewhat, nevertheless gales have been reported even when there was no evidence of a cyclone.

Transition season, October and November.—In October the South-west monsoon retreats. In the northern part of the Bay, the winds are rather variable in direction with frequent easterlies and north-easterlies ; southward of lat. 15° N., south-westerlies still prevail though they become unsteady. The average strength of the south-westerly winds is force 3 to 4, but they often increase to force 5 to 7. The north-easterly winds average force 2 to 3. October and November are the most treacherous months of the year in the Bay ; fine weather may last for a considerable time, particularly in the north and centre, on the other hand the most severe cyclones of the year may develop.

By November north-easterly winds have spread to all parts of the Bay, but they are much steadier northward of lat. 10° N. than further south, where winds from south-west and west are as frequent as those from a north-easterly direction.

Cyclones.—Tropical revolving storms occur in the Bay of Bengal, where they are known as cyclones. They often develop on a front between moist equatorial air and air of a different origin. Thus, they are most prevalent over the Bay as a whole during the transition seasons in May and from October to November, but they are rare during the North-east monsoon. During the South-west monsoon season they occur mainly near the head of the Bay where the moist South-west monsoon air may come into contact with air off the land having quite different characteristics.

Most cyclones are of only moderate intensity and have no inner ring of winds of hurricane force blowing round a calm centre. One or two a year may be expected to be severe. Southward of lat. 10° N. they are usually much less severe, though very heavy rain may be experienced with them. The Indian Meteorological Department uses the expression "tropical depression" for those cyclonic circulations in which the wind is of force 7 or less ; the depression becomes a "storm" when there is evidence or reason to believe that the wind in a part of the cyclonic circulation has risen to gale force ; if the wind reaches force 10 or more, with occasional hurricane squalls, the storm is said to be severe.

Further information regarding tropical storms, and instructions as to the best way of manœuvring if caught in one are given in the standard article entitled "Tropical revolving storms," see page xxxiv.

Frequency and season.—The table below gives the number of moderate and severe storms which occurred in each month in the Bay of Bengal during the 48 years from 1891 to 1938. It will be seen that storms occur chiefly from April to December, and that severe storms are most likely at the transition periods in May and from October to November.

Total number of storms in the Bay of Bengal in the period 1891–1938.

Month	Number of storms in any part of the Bay			
	Severe	Moderate	Total	Av. No. per year
January	0	3	3	0.1
February	0	0	0	0.0
March	2	3	5	0.1
April	6	9	15	0.3
May	12	8	20	0.4
June	2	23	25	0.5
July	5	18	23	0.5
August	1	14	15	0.3
September	6	14	20	0.4
October	13	21	34	0.7
November	16	25	41	0.9
December	5	14	19	0.4
Year	68	152	220	
Av. No. per year . .	1.4	3.2	4.6	

Tropical depressions (disturbances in which the winds do not exceed force 7) develop chiefly during the South-west monsoon from June to October when there are likely to be one or two a month.

Regions of origin and tracks.—Most of the cyclones that affect the weather in the Bay of Bengal form in the Bay itself. A few, however, originate as typhoons in the China sea, and these, after travelling across the land, intensify again on reaching the Bay and re-form as storms or depressions. The season most favourable for the travel westward of China sea typhoons is from July to October, particularly September and October (*see* Figures 5-14).

The following information has been extracted from "Winds, weather and currents on the coasts of India, and the law of storms" published by the India Meteorological Department.

January to March.—The Bay of Bengal is practically free from cyclones during these months; but a few are known to have formed off Ceylon westward of long. 86° E., and these moved in directions between west-south-west and north-north-west.

April.—The cyclones of this month form mainly in the southern part of the Bay and less frequently in the vicinity of the Andaman islands. They generally move in a northerly or north-easterly direction towards the coast of Burma.

May.—Cyclones generally form in the centre of the Bay or in the vicinity of the Andaman islands, and may travel in a north-north-westerly direction frequently re-curving north-eastward; thus they may strike any part of the coast. They are sometimes as violent as any that occur, not excluding those of October, but are nearly always of small size.

June to August.—Cyclones mostly occur northward of the parallel of 16° N. They usually travel in a westerly or north-westerly direction towards the coasts of Orissa and West and East Bengal, though one in June travelled north-eastward and struck the coast of Arakan near Akyab.

September.—The cyclones during this month mostly occur northward of the parallel of 16° N. They may move in any direction between west and north-north-east, but usually move north-westward.

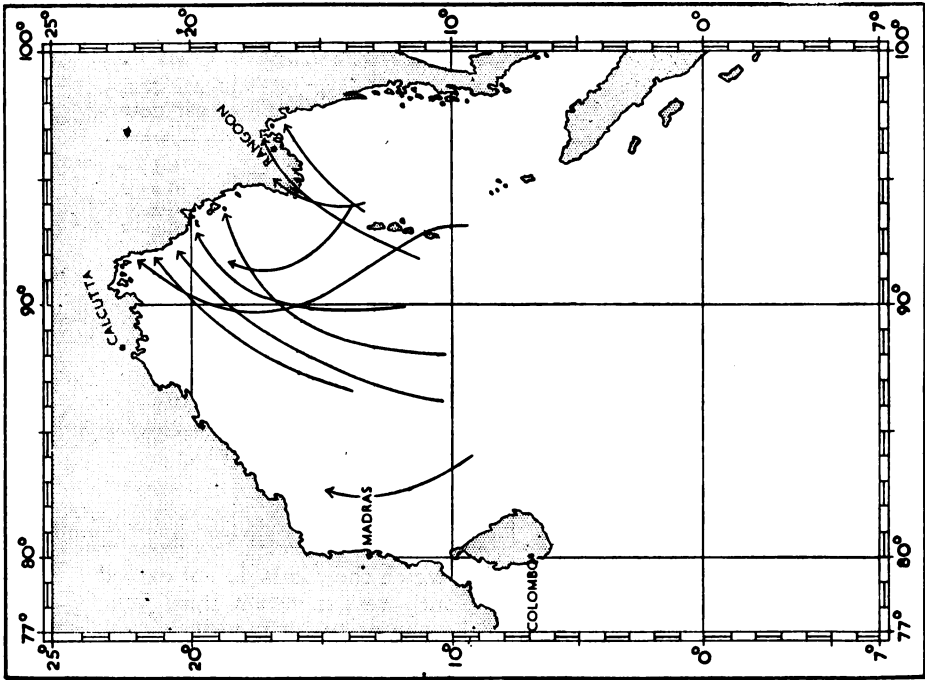


Fig. 6.—April

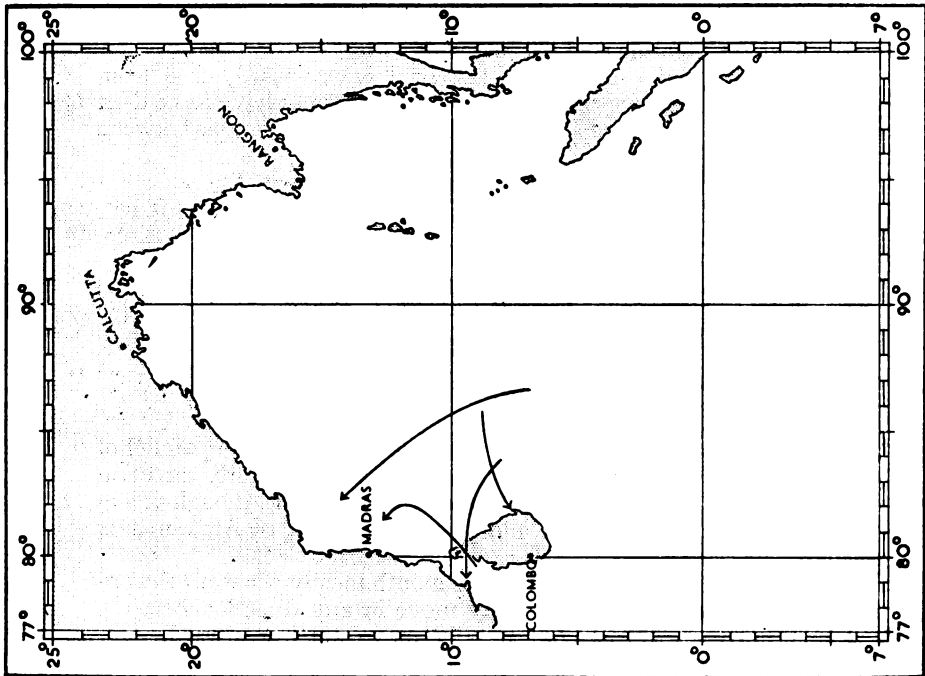


Fig. 5.—January, February and March

TYPICAL TRACKS OF CYCLONES

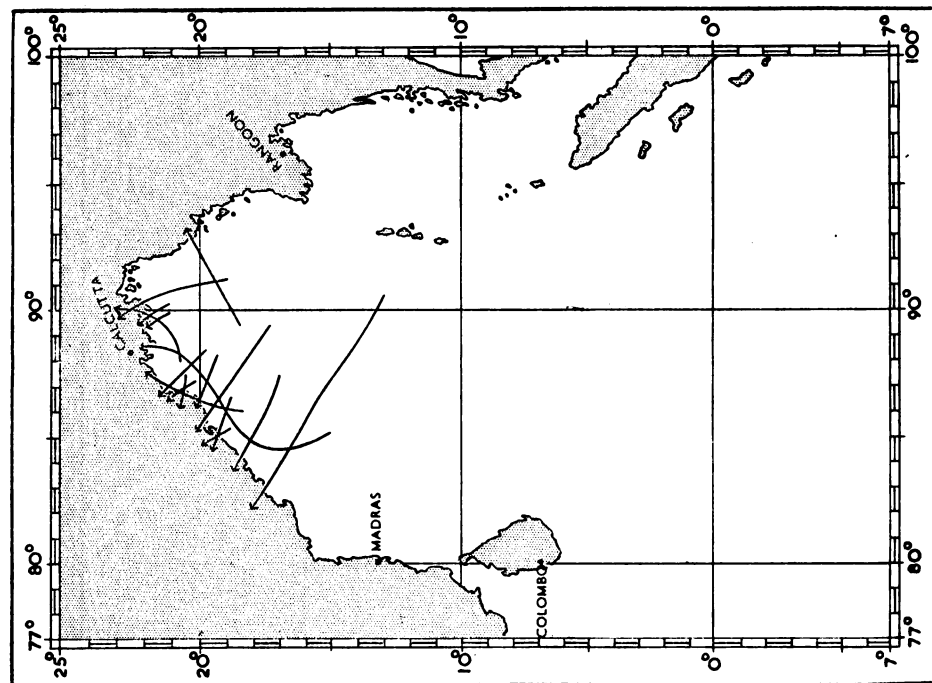


Fig. 8.—June

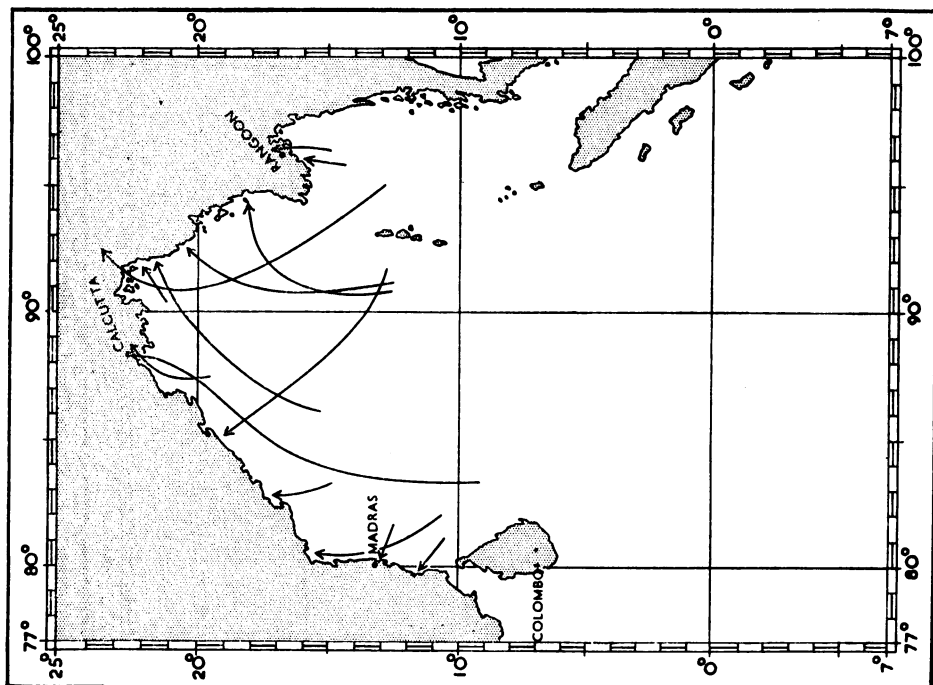


Fig. 7.—May

TYPICAL TRACKS OF CYCLONES

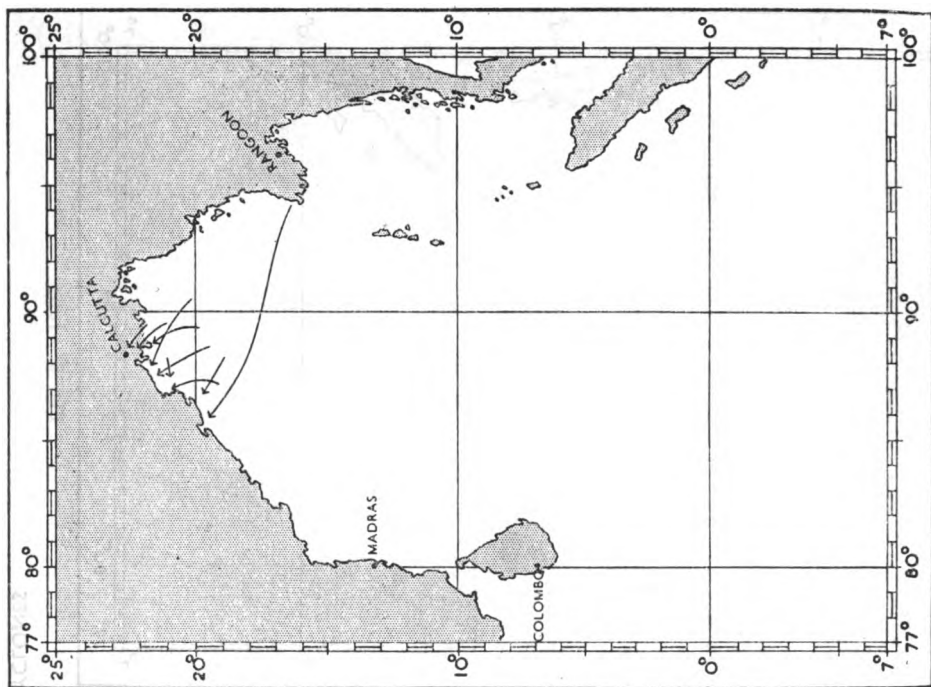


Fig. 10.—August

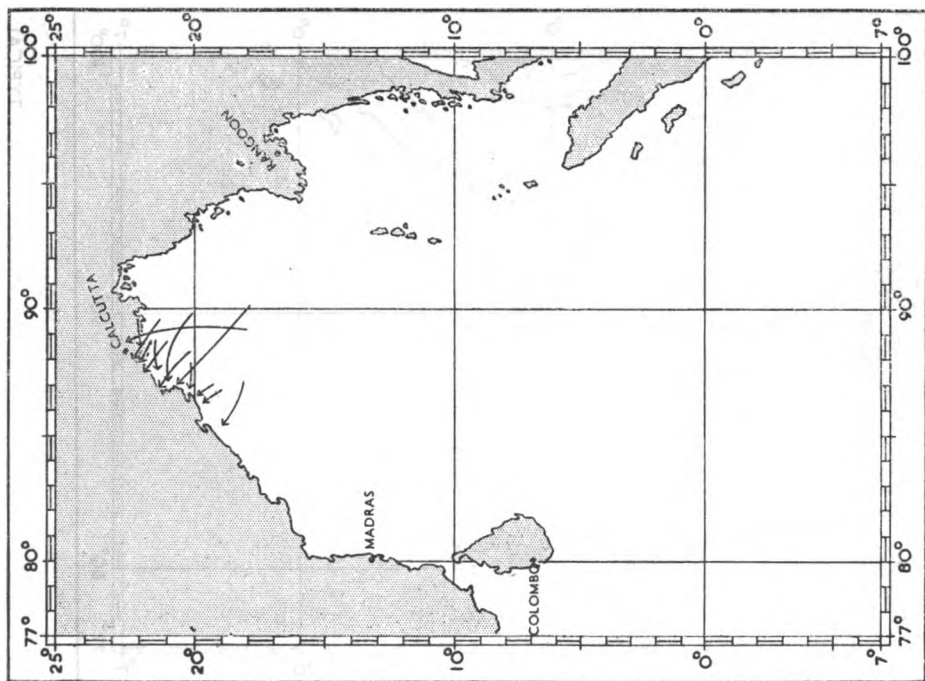


Fig. 9.—July

TYPICAL TRACKS OF CYCLONES

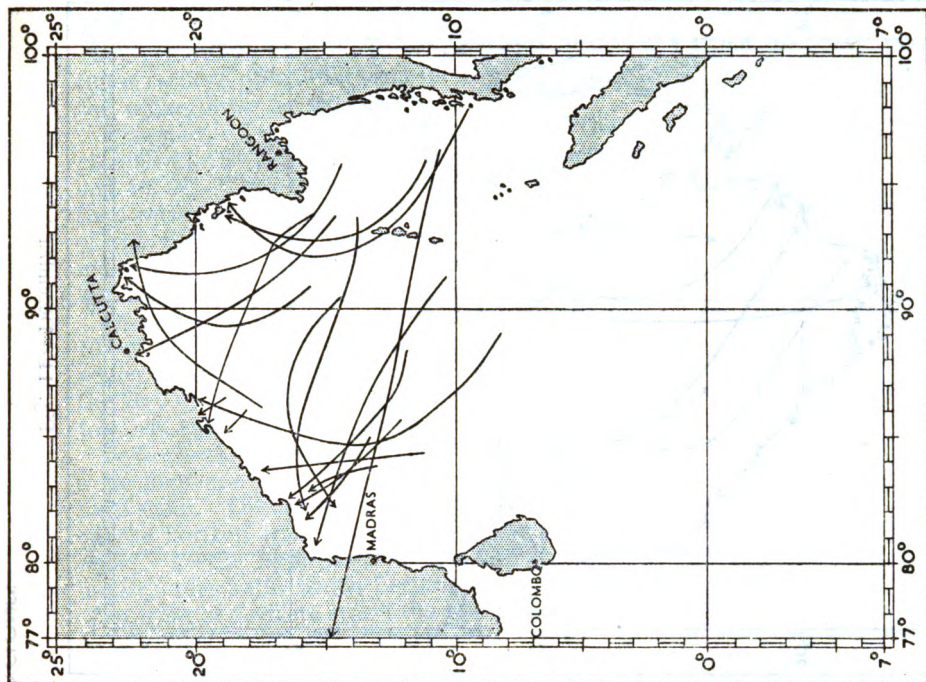


Fig. 12.—October

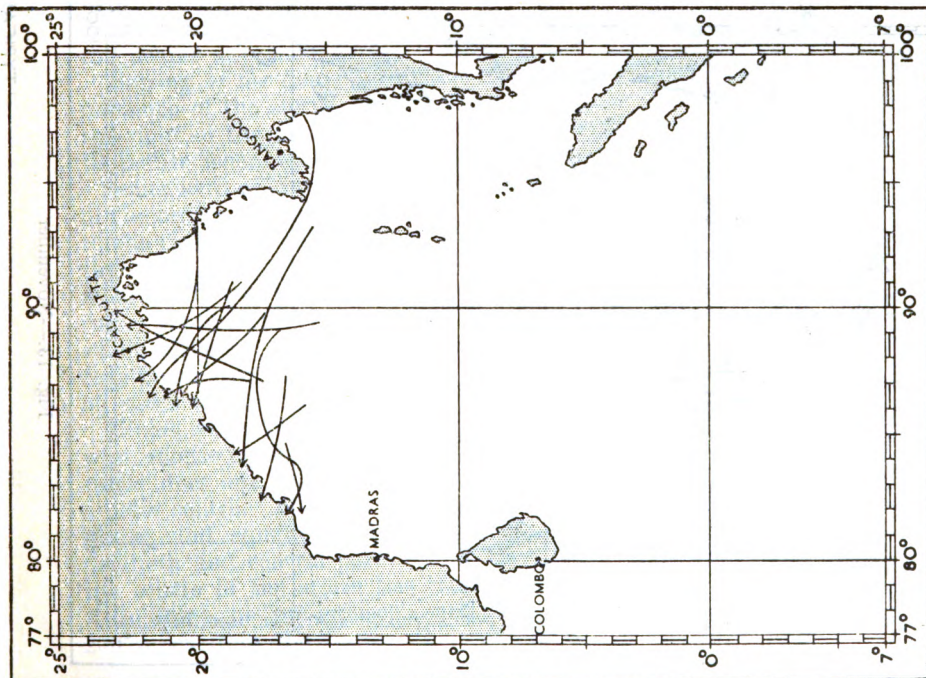


Fig. 11.—September

TYPICAL TRACKS OF CYCLONES

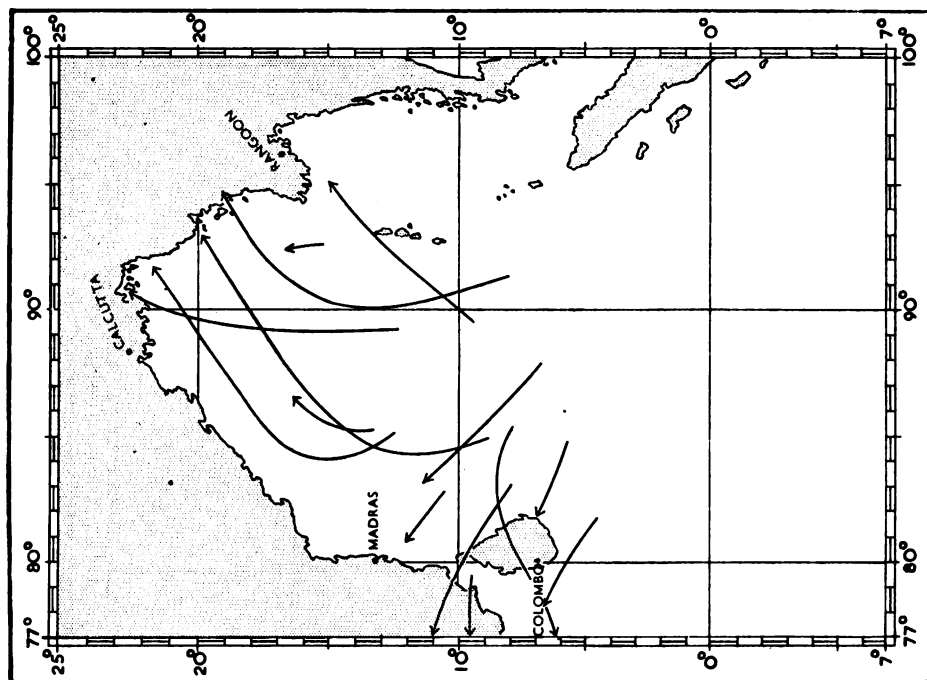


Fig. 14.—December

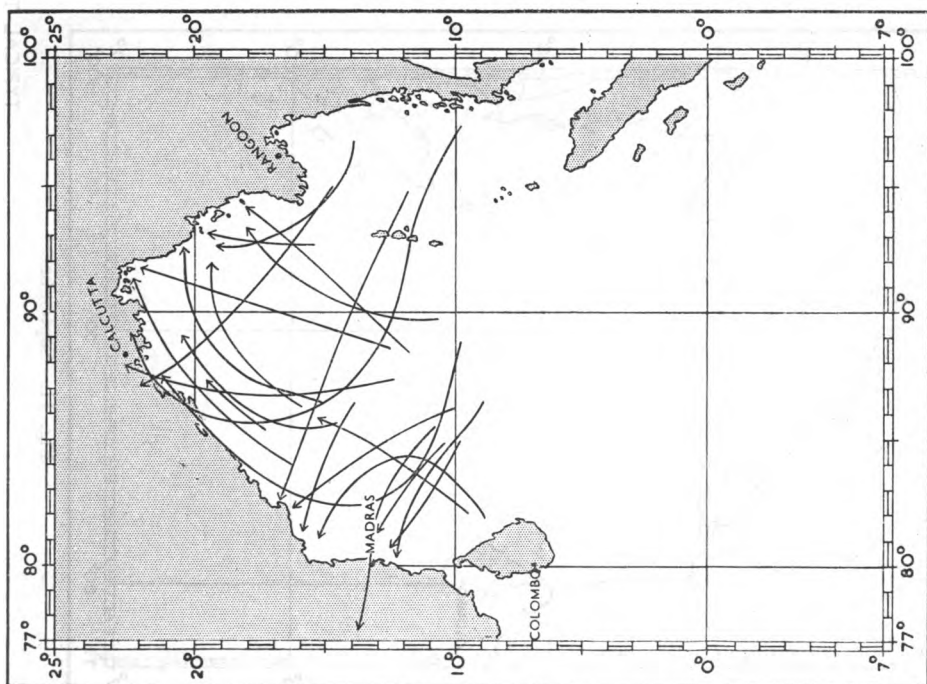


Fig. 13.—November

TYPICAL TRACKS OF CYCLONES

October.—In this month cyclones may form in any part of the Bay. They generally move in a direction between west and north and sometimes recurve north-eastward in their later stages. Thus any part of the coasts may be affected.

November.—Cyclones form in any part of the Bay southward of the parallel of 16° N., the majority forming between the parallels of 8° and 16° N. They move in a north-westerly or northerly direction and then recurve north-eastward, frequently advancing towards the head of the Bay. Those forming south of the parallel of 12° N. usually move west or north-west towards the coast of Madras. Any part of the coasts may be affected.

December.—Cyclones usually form southward of the parallel of 16° N. in the central or south-western part of the Bay. The former, which are mostly severe, recurve north-eastward towards the head of the Bay or the coast of Burma; the latter move west-north-westward towards the coast of Madras.

Indications.—The most important indications of the approach of a cyclone are given in the section on "General Navigation" on page xxxii. Other signs are: the appearance of a dense bank of cloud on the horizon from which almost continuous lightning is visible at night; a still, oppressive atmosphere; and a succession of squalls, usually with rain, which become more frequent as the wind rises.

In front of a severe storm the first indication of its approach is likely to be given by the swell. This comes from the direction from which the storm is approaching. It moves at a higher speed than the storm itself, and over the open sea it often travels to great distances. It may give warning of the existence of a storm one or two days before the other signs are sufficiently definite.

The usual indications that a cyclone is forming northward of a ship, or, alternatively, that a ship is approaching a cyclone from the south, are squally south-westerly or southerly winds, increasing in strength, with falling pressure and increasing cloud. The occurrence of a succession of rain squalls of increasing violence and frequency indicates the nearer approach to the centre.

Bearing of the centre.—Northward of lat. 15° N. when within the influence of the storm, the bearing of its centre is about 11 points to the right of the direction from which the wind is coming, and about 10 points when within 50 miles of the centre.

Southward of lat. 15° N., in the outer part of the storm the bearing of the centre is about $11\frac{1}{2}$ points, and near the centre about 10 points to the right of the direction of the wind. When on the outer edge of the storm, say, 500 miles from the centre, there may be an error of from one to two points in the bearing obtained by applying the above rule. As the wind increases in force, however, the rule becomes more exact, although, owing to local irregularities of wind circulation there may be an error of about a point in the estimated bearing when within 50 miles of the centre.

Winds and weather.—The cyclones which form during the South-west monsoon season are usually of moderate intensity, and only rarely does one develop an inner ring of storm winds blowing round a calm centre. Forming in the northern part of the Bay they cause strong and squally southerly and south-westerly winds over the northern and central parts of the Bay, these winds continuing after the centre of the storm has crossed the coast.

In front of pre-monsoon and monsoon storms, beyond about 200 miles from the centre, the weather is fine and often calm and

sultry, and no bad weather is experienced until the centre of the cyclone is within 200 miles. In the rear the weather is squally and rainy for from 400 to 500 miles from the centre, south-westerly winds prevailing southward, and a southerly to south-easterly gale far eastward of the vortex.

Cyclones of the transition months, October and November, are likely to be more intense than those of the previous months, with winds of storm force blowing round a calm centre. The shifts of wind may be rapid and dangerous. Another dangerous feature is the high and confused sea in the centre of the storm; this advances with the storm and strikes the coast as a storm wave. Should it reach the coast near the time of high tide, extensive floods may result.

In these storms during October and November, the sky becomes clouded with cirrus and cirrostratus even at a distance of 500 miles or more from the storm centre, and as the storm approaches, the clouds lower to altostratus, nimbostratus and stratocumulus. The precipitation extends to distances of about 200 miles from the centre and is accompanied by heavy squalls as the centre is approached. The heaviest precipitation occurs in front of the storm. In the rear the weather is showery, but occasional squalls may also be experienced.

Navigation during the cyclone season.—When running up the Bay of Bengal with a strong south-westerly wind, occasional squalls and rain, and a slowly-falling barometer, bad weather prevails somewhere northward.

Between the beginning of June and the middle of September, when any storm centre is probably northward of lat. 16° N., and in July or August still farther northward, a sailing vessel should steer eastward and take advantage of the southerly and south-easterly winds on the eastern side of the storm as it moves north-westward. But should the weather get rapidly bad, and the barometer continue to fall, then heave-to, and determine the position with regard to the movement of the storm before proceeding.

In May, October or November, when the storm travels in some direction from west, through north, to north-east, its course should be ascertained with certainty before any attempt is made to round its eastern side, as, if it is moving north-eastward, such a proceeding would be attended with danger.

When leaving the Hooghly from June to September, in addition to the storm signals which are made, an indication of the approach of a cyclonic storm, or of the existence of a storm in the northern part of the Bay, is given by easterly winds and a falling barometer. As a vessel standing southward would most likely run into the storm, the river should not be left until the weather has moderated.

In May, October and November, a squally easterly or north-easterly wind driving low, long-drawn masses of cloud before it, or a strong westerly current at the head of the Bay of Bengal, indicate that a cyclonic storm is in the northern part of the Bay, and a vessel should not proceed southward until finer weather prevails; in these months, however, although there may be every appearance of fine weather in the Hooghly river or at any port at the head of the Bay, there may nevertheless be a cyclonic storm far down the Bay. With these conditions, on the first indications of the coming storm the changes of the wind and barometer should be carefully watched, and the course of the storm be determined if possible.

If in the right-hand semicircle a sailing vessel should be hove-to on the starboard tack until the storm has passed, and if undoubtedly in

the left-hand semicircle, should heave-to on the port tack if the wind is eastward of north, or run southward, keeping the wind on the starboard quarter, when the wind is north or westward of north.

On the approach of a cyclonic storm, vessels lying in the roadsteads of the Coromandel coast usually run southward round its rear, and this is probably the only course open to sailing vessels; but full-powered steamers, leaving while the centre is still more than 100 miles distant, and the wind between north and north-north-west, might, if necessary, proceed north-eastward, if it has been ascertained that the storm is not moving north-westward or northward.

Vessels leaving Rangoon or Moulmein, and encountering strong north-easterly winds, with a falling barometer, denoting the existence of a cyclonic storm eastward of the Andaman islands, should delay their departure until the storm has passed. This is indicated by a rising barometer, and a shift of wind to east or southward of east.

Nor'westers.—This is the name given to a severe type of thunder-storm, accompanied by strong squalls, which occurs occasionally in West and East Bengal and the neighbouring regions and may affect the waters at the head of the Bay. These storms derive their name from the fact that they usually approach from north-westward, though squalls from northward and north-eastward are not unknown. They are mainly confined to the hot months, from March to May, but they have been experienced also in the latter half of February and in the first half of June. The arrival of the South-west monsoon puts an end to them.

The first sign of one of these storms is a low bank of dark clouds in the north-west, the upper outline of which has the appearance of an arch. The storm leaves the land slowly at first and gathers speed over the sea and arrives with a strong gust or squall. Thunder and lightning usually occur, followed by heavy rain, and occasionally hail. A wind speed of 100 knots has been recorded in one of these storms.

Nor'westers nearly always occur in the afternoon or evening after a close, warm day. They rarely last more than three or four hours and they are generally followed by cool, clear weather. At Calcutta they usually occur about or just after sunset.

Western depressions.—During the season from November to May depressions sometimes travel across India from the west. They pass northward of the Bay, but they may cause cloud, rain and squally weather on the coasts of Orissa, the Sundarbans and East Bengal. From December to April, there may be one or two of these depressions per month. In November and May they only occur very occasionally.

Gales.—Gales occur chiefly during the South-west monsoon season, particularly in July and August. In these months the stormiest region is the part of the Bay northward of lat. 15° N. and eastward of long. 90° E. (see Figure 16, which shows that in July, Beaufort force 7 or more has been recorded at about one observation out of every ten over most of this region). Most of the gales blow from south-west or west-south-west.

Winds of gale force are only rarely experienced in the months from December to March (see Figure 15, which shows that in January it is only in some parts of the Bay southward of about lat. 15° N. that Beaufort force 7 or more has been recorded at one observation out of every hundred). In the transition months gales occur with cyclones; in about one of these cyclones per year the gales are likely to reach or exceed force 10.

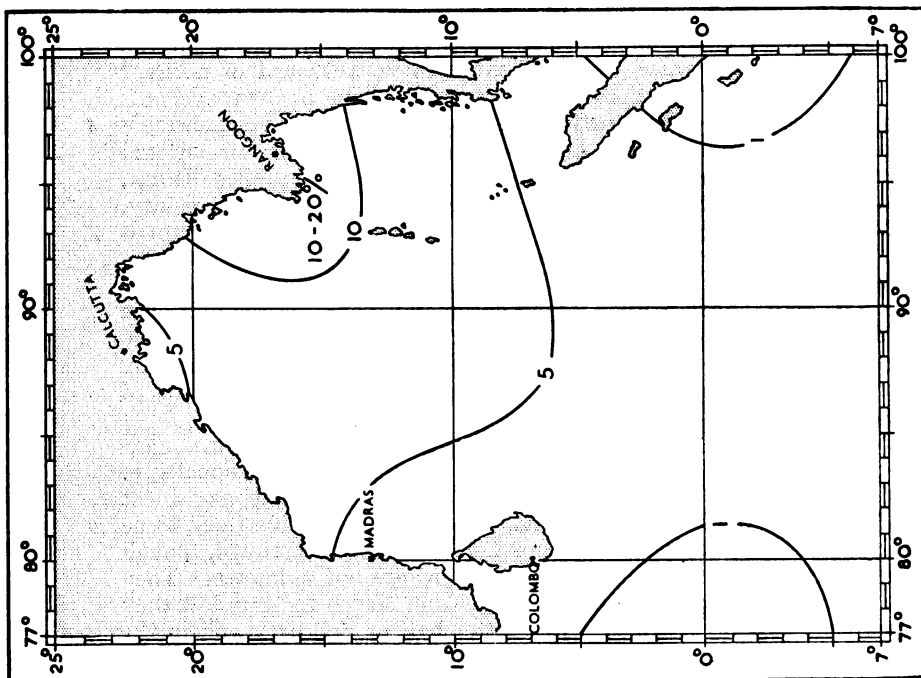


Fig. 16.—July

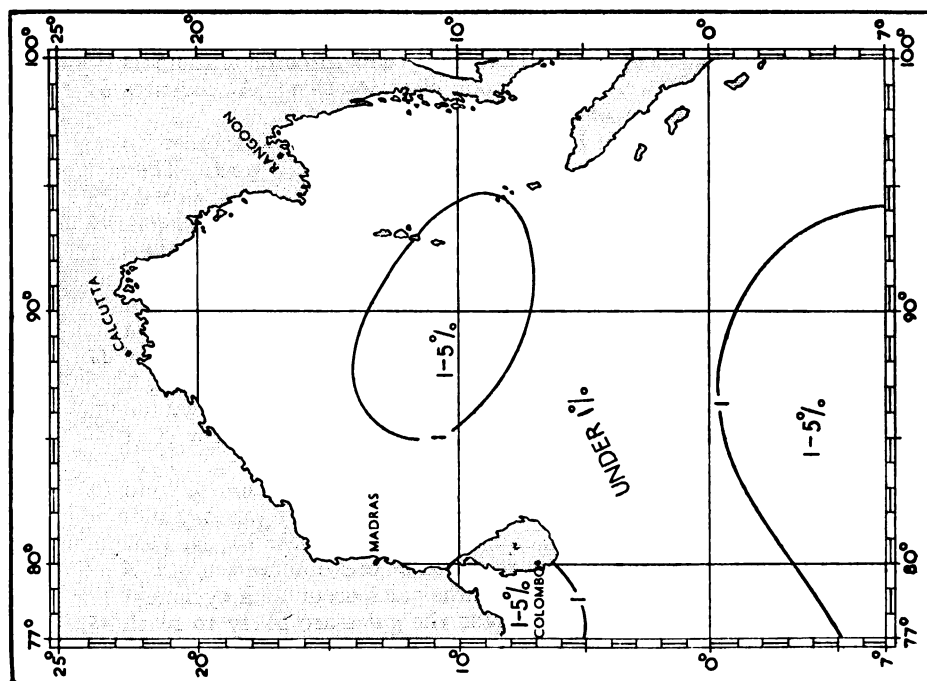


Fig. 15.—January

PERCENTAGE FREQUENCY OF GALES
(Wind Beaufort force 7 and over)

Ceylon.—Sustained strong winds are not common in Ceylon, except in May or June with the onset of the monsoon. On the west coast at this time winds sometimes average from 25 to 35 knots for several hours, and gusts up to 50 or 60 knots may occur. The wind velocity reaches gale force (33 knots or over) on about 36 days per year at Colombo (*see the climatic table,* page 70), mainly during the South-west monsoon. Outside this monsoon period, strong gusts are rare at Colombo in the night and morning, and occur most frequently between 1400 and 2000. Although they consist mainly of increases in wind speed without much change in direction, cases are not infrequent in which there is a considerable change of direction with the advent of the gust.

Local winds.—Land and sea breezes (*see standard article, page xlv*) develop on the coasts chiefly in the periods between the monsoons. During a monsoon these breezes are most marked on those coasts which are sheltered from that monsoon.

In the evening the land breeze begins sooner near the coast than farther out; during the night, moreover, it is stronger and steadier near the coast than farther out. During the morning on the other hand the sea breeze first appears at some distance from the coast. By noting these points sailing vessels can often gain advantage from the land and sea breezes.

Much of the following information has been extracted from "Winds, weather and currents on the coasts of India and the law of storms" published by the India Meteorological Department.

Gulf of Mannar and west coast of Ceylon.—The North-east monsoon normally begins in the second half of November, is heralded by thunderstorms, and lasts until March. Along the northern shore of the Gulf of Mannar it blows from north-north-east; at Pamban it is light in the morning and freshens about noon. On the eastern shore of the gulf, land and sea breezes make the wind direction very variable during this monsoon; it is less variable on the western shore, which is more exposed to north-easterly winds. The weather is usually good except for occasional squalls during heavy rain. In April winds become variable, rain squalls occur, and a swell from westward is experienced.

The South-west monsoon begins in May; it strengthens in June, when fishermen seldom go to sea, and moderates somewhat in July, when rain squalls are less frequent. Winds blow chiefly from between south-west and west. Near the head of the gulf the wind is usually moderate in the morning but strong in the afternoon. Fresh winds between south-west and west continue through August and September; the weather is then generally fine. At the beginning of October the winds are mainly from between south-west and north-west, but late in the month and in early November they are variable with squalls and rain.

East coast of Ceylon.—From February to April, the weather is almost invariably fine, but occasional light squalls accompanied by thunder and lightning, occur at the end of this period. In May, the winds become south-westerly with cloudy skies, and the South-west monsoon sets in during this month. The hills of Ceylon shield the southern part of the east coast from the full force of the South-west monsoon, but at some distance off the coast, as well as on the south coast, isolated rain squalls are of frequent occurrence. The monsoon weakens generally during September and October, but the force of the south-westerly winds in these months is very variable. After a period of light,

variable and unsteady winds, the North-east monsoon sets in, generally about the end of November or early in December, and continues in strength until about the end of February, after which month the wind is mainly light until the South-west monsoon begins in May.

5 Sea breezes are well marked in the transition periods between the monsoons and during the monsoons in the lee of the hills. Land breezes are not very marked in Ceylon. During the transition periods when the sea breeze is strongest the nights are usually calm.

Coromandel coast.—The weather is generally calm during the first
10 half of October, but later the North-east monsoon sets in and prevails till about the middle of February. The land and sea breezes are weak throughout this period, though they are usually sufficient to deviate the monsoon winds. At Madras, during this period, since the prevailing winds are from between north-east and south-east, there is an almost
15 continuous onshore wind except for a few hours of the night and early morning. November is the month when the coast is most liable to be affected by severe cyclonic storms travelling westward or north-westward from the southern part of the Bay and causing spells of strong winds, severe rain squalls and rough seas. The weather
20 improves in December and is generally fine in January. In February the north-easterly winds are weaker and less steady. Thereafter, land and sea breezes strengthen; they increase rapidly during March and April, and are most strongly in evidence during the period from May to September, except on those days when the South-west mon-
25 soon is strong. The land wind blows in the morning after sunrise, the sea breeze commencing in the early afternoon. In March and April, south-easterly breezes become strong during the day. They veer southward as the monsoon advances, sometimes following the general trend of the coast. Occasionally, in May, a westerly wind prevails
30 throughout the days so that the sea breeze is not apparent. During the first half of May, depressions may move in a westerly direction towards the coast of Madras, and for a time cause rough and squally weather. In June, south-westerly winds prevail, but only occasional showers and rain squalls occur in this month. On those days when
35 the South-west monsoon is strong, the sea breeze either does not set in at all or lasts only for a very short time. During July, August and September, the south-westerly wind becomes weaker and rain squalls become more and more frequent.

At Madras the sea breeze commences most frequently between 1100
40 and 1300 in May, but as the season progresses and the westerly winds become stronger, the sea breeze sets in later, in July between 1400 and 1600. As the monsoon weakens, the sea breeze again sets in earlier, and in October it occurs on most days before 1300.

Circars coast.—Winds are mainly north-easterly in November and
45 December, easterly to south-easterly from January to mid-March, and then southerly to south-westerly until early May; during the period from mid-November to late April, the weather is in most years persistently fine and dry. In May and June cyclonic storms approach this coast and affect the weather. Steady south-westerly winds
50 predominate from June to the end of August, increasing in strength somewhat during the afternoon. During the withdrawal of the South-west monsoon, in September, October and November, rain and squally weather in association with cyclonic storms continue to affect this coast. In October the winds shift to the northward and
55 gradually the north-easterly winds appear and hold steadily, with little change in force during the day. By the end of October or early

November, light land and sea breezes begin and gradually increase in strength thereafter.

Coasts of Orissa and West and East Bengal.—In the middle of October the South-west monsoon winds are replaced by light variable northerly to north-easterly winds. As the season advances these northerly winds increase in steadiness. From the beginning of October to the middle of December, cyclonic storms may affect the winds and weather on these coasts. During January and the greater part of February, dry northerly winds with fine weather prevail except during the brief periods when western depressions cross the north-eastern part of India and cause southerly winds, cloudy weather and occasional squalls. On the Chittagong coast regular land and sea breezes prevail from the end of October to the middle of March, but at Chittagong itself these winds rarely reach force 4. 5 10

In March southerly winds become fairly common. They are generally light in that month but increase in strength until about the middle of June; at times they blow strongly. 15

During April, May and June, afternoon and evening thunderstorms and nor'westers occasionally pass seaward across the coasts of Bengal or Orissa; these may be felt up to distances of from 70 to 80 miles from the land. 20

The South-west monsoon normally reaches these coasts in the second or third week of June, and withdraws in October. While it lasts, winds are predominantly south-westerly on the coast of Orissa, and southerly or south-easterly on the coasts of West and East Bengal. These winds strengthen during the afternoon except during very cloudy weather. The onset of the monsoon winds usually takes place in the rear of a cyclone of moderate intensity that has formed near the head of the Bay. The weather during the monsoon alternates between stormy periods with showers and rain squalls, associated with depressions or cyclones, and fair periods, with light variable winds, these fair periods being of any duration up to several weeks. 25 30

Arakan coast.—From November till the end of February, light northerly winds prevail, being north-easterly in the morning and north-westerly in the afternoon. From March to May, which is the hottest season, marked land and sea breezes are experienced. At Akyab, the land breeze is generally light but a sea breeze of force 4 is common. From October to December and also during April and May, cyclonic storms sometimes form near the Andaman islands or at some distance to the westward or north-westward of them; these pass by a curved path to the Arakan coast giving rise to rain and squally weather. During the rainy season, from June to September, strong southerly to south-easterly winds predominate, increasing slightly in strength during the day. 40

Lower Burma coast.—From November to February, the winds are mostly northerly or north-easterly except in the afternoon when an onshore wind is more common. During the next three months the predominant wind changes to west and then south-west. Land and sea breezes increase with the advance of the season and are pronounced in February. 50

Occasionally, during April and May, cyclonic storms form in the vicinity of the Andaman islands and, travelling generally northward or north-eastward, cause stormy weather on the coast between Diamond island and Moulmein. During the rainy season, from June to September, the winds are generally south-westerly, steadier than in the preceding months, but of no great strength, rarely rising above force 3. 55

These winds change little in direction until September when they begin to shift eastward. The monsoon winds usually withdraw from the Lower Burma coast by the end of October and are replaced by light variable or north-easterly winds which gradually strengthen in 5 November into the dry winds of the cool monsoon.

The Coco group, Andaman and Nicobar islands.—At Port Blair, in the Andaman islands, the winds during the North-east and South-west monsoons blow very steadily during the day, falling off in strength markedly at night. At Table island, the northernmost island of the 10 Coco group, winds of force 4 or more are frequent throughout the period from June to September.

Cloud.—Over most of the region the skies are clearest during the North-east monsoon, and cloudiest during the South-west monsoon, from June to September. Exceptions to this distribution are the 15 east coast of Ceylon which has most cloud during the North-east monsoon, and the Pamban and south Coromandel coasts where November and December are the cloudiest months.

During the North-east monsoon, from December to March, the skies are clearest over the northern and eastern parts of the Bay, where 20 average amounts are from about 1 to 3 oktas. In the north, the occasional passage of a western depression produces an overcast sky. The North-east monsoon is dry as it leaves the land in the north and east but it gradually picks up moisture as it crosses the sea, giving rise to cloud as it travels further south-westward. Southward of lat. 25 15° N., in the central and western part of the Bay, however, the amount of cloud is controlled by the activity of the monsoon. While it is blowing strongly the skies are generally overcast, and they clear when it weakens.

Cloudiness increases in most regions during April and May, the 30 clouds being mainly of the cumulus type. In the north, heavy cumulonimbus clouds develop during Nor'westers. In the south, the cloudiness in May is chiefly associated with thunderstorms which precede the advance of the South-west monsoon. At places where the monsoon breaks in May there is low cloud.

35 During the monsoon months from June to September, the cloud amount averages from 5 to 7 oktas in most regions. Clouds are chiefly cumulus and cumulonimbus. During the heavy rain associated with monsoon squalls, the base of the cloud may descend to 300 feet above the sea. Cloudiness decreases in September, especially in the north 40 and east.

In October and November, cloudiness decreases everywhere except in the south-west, on the east coast of Ceylon and on the Pamban and south Coromandel coasts, where this is the cloudiest season of the year. Much of the cloud in these regions is due to thunderstorms associated 45 with the withdrawal of the monsoon or with depressional activity.

Rain.—Most of the rain in the Bay of Bengal and on its shores is brought by the South-west monsoon. It is those shores which are fully exposed to the monsoon which have the heaviest rainfall. For example, on most of the coast of Burma the yearly amounts average 50 100 inches or more. On coasts which are sheltered from the monsoon, for example, the Coromandel and South Circars coasts, the yearly amounts average only about 40 inches. Over the sea the amount of rain increases from west to east; it has been estimated that the amount east of long. 90° E. is about double the amount west of 55 long. 85° E.

Over most of the region the North-east monsoon is the dry season ;

but the south-western part is an exception to this distribution. The Coromandel and South Circars coasts have their wettest period during the transition months of October and November. The east coast of Ceylon, also, is sheltered from the South-west monsoon and receives most of its rain from October to January. The west coast of Ceylon has rainy seasons at the two transition periods, May and October to November. 5

Local information about rain on the different coasts is given below.

Ceylon.—The south-western part of the coast of Ceylon is the wettest, having about 100 inches of rain a year; the driest parts are the north-west and south-east, with about 40 inches. 10

On the west coast, February is usually the driest month. The rain in the early months is chiefly in the form of thunder showers in the afternoon or early evening; these become more frequent towards the end of March and in April. During May the onset of the South-west monsoon is accompanied by rain squalls and periods of continuous rain, which is heavy in the south-west but much lighter in the north-west. The rain decreases as the season advances, but becomes frequent again at the change of the monsoons during October and November. 15

On the east coast the dry season lasts from February to September, though showers normally occur in every month. There is a considerable increase of rain in October, and the arrival of the North-east monsoon in November is accompanied by thunderstorms and heavy rain which continue into December. 20

Falls of rain in Ceylon are sometimes very heavy. At Colombo a rate of more than 0.1 inch a minute is often experienced for 3 or 4 minutes and a fall of 2 inches in half-an-hour or less is experienced on an average about once in two years. On one occasion 5.6 inches fell in an hour. 25

Data for Colombo and Trincomalee are given in the climatic tables on pages 70 and 71. 30

East coast of India and coast of East Pakistan.—Along the east coast of India as far north as about lat. 17° N. the wettest period is at the change of the monsoons during October and November. Heavy rain squalls sometimes occur with tropical storms and depressions in these months. There is an improvement in December, and from January to June there is little rain; though there may be occasional thunderstorms in the hot season, and in May tropical cyclones occasionally bring heavy rain. From July to September rain squalls become more and more frequent. 40

Along the coast of India northward of about lat. 17° N., the wet period becomes gradually earlier, until at the head of the Bay it is concentrated in the South-west monsoon season from June to September, the wettest months being July and August. During this season there is much squally and rainy weather, and in the wettest months rain occurs on more than half the days. In October and November there is sometimes very heavy rain with cyclones. On the coasts of Orissa and West and East Bengal, there is usually rain in the cool season when western depressions pass; in the hot season there are occasional very heavy showers with thunderstorms and nor'westers. 50

Data for six ports on the east coast of India and for Chittagong in East Pakistan, are given in the climatic tables on pages 72 to 78.

Coast of Burma.—On this coast the dry season lasts from the end of November to the end of April. There is a good deal of rain in the latter part of May, and during the months from June to September. Except on those few parts of the coast where mountains afford shelter 55

from the South-west monsoon, rain falls nearly every day while this monsoon is blowing, which is normally the case from June to September. The rainfall is very heavy on some parts of the coast, for example, the average for July at Rangoon is 21 inches and at Akyab 5 nearly 56 inches (more than double the average for the whole year in south-east England). About 30 miles seaward the amounts are probably considerably less. The rainy season gradually dies out in the course of October and November.

The wettest parts of this shore are the Arakan coast between Akyab and Sandoway, and the coast of Tenasserim from Moulmein to Tavoy, where the yearly amounts average about 200 inches. On many parts of the coast amounts of from 6 to 8 inches have fallen in 24 hours. At Akyab falls of 15 and 16 inches in 24 hours have been recorded.

Data for five ports are given in the climatic tables on pages 79 to 86. 15 *The Coco group and the Andaman and Nicobar islands.*—Here the rainy season sets in during May, in which month the rainfall is heavy. The wettest months are June and September, though the wet season continues until early December. The driest months are from January to March.

20 Data for three ports are given in the climatic tables on pages 80 to 82.

Hail.—Hail is infrequent. It falls occasionally with the Nor'westers on the coasts of Orissa and West and East Bengal, and is sometimes destructive.

Thunderstorms.—Thunderstorms are rather frequent in the 25 transition periods, and on most coasts they are nearly as frequent during the South-west monsoon; this is not the case, however, in Ceylon, where they seldom occur between June and September but are very common from March to May and in October and November.

Waterspouts.—Waterspouts are seen in the Bay of Bengal, most 30 frequently in the two transition periods of the monsoons.

Visibility and fog.—Visibility is usually good in fine weather, especially at sea; often it is very good.

The chief cause of bad visibility at sea is heavy rain, and, when the rain is very heavy, visibility may be reduced to half a mile. In the 35 severe squalls which occur with the more violent cyclones, the combined effect of the rain and spray may reduce visibility to less than 100 yards.

On and near the coasts, visibility may be reduced at times by fog, mist or haze as well as by heavy rain. Fogs and mists are most prevalent 40 over the land in the cool season, though in some districts they occasionally form at other times of the year.

Data of the number of days with fog are given for several ports in the climatic tables on pages 70 to 86.

Ceylon.—On the west coast of Ceylon, fog is unknown. Early 45 morning mist is rather frequent during the North-east monsoon but usually disappears soon after sunrise; apart from that, visibility is usually good in this season. Very little information is available for the east coast, but observations at Trincomalee indicate that mist is rare, except, possibly, in the early morning.

50 *East coast of India.*—Fogs sometimes form in the river valleys, chiefly between November and March. They may be dense enough to impede navigation on the rivers, but they usually disperse between 0800 and 1000. Early morning mist is said to be frequent at Madras during the North-east monsoon. False point lighthouse has occasionally 55 been reached by land fog in the months from January to March. (See also page 221 for caution with regard to False point light.)

Coasts of Orissa and West and East Bengal.—Off the Sundarbans and in the Hooghly river from the middle of November to the end of March, fog and smoke haze are prevalent. Fogs and mists tend to form in the evening on the low ground and over the river, and to persist until the morning; these fogs may come on suddenly. The bad visibility is increased by the smoke haze from the city of Calcutta, which is carried southward by the prevailing northerly winds. At Calcutta itself visibility is less than two miles on most evenings between October and January, and on nearly every morning between October and March. At Chittagong, also, visibility is frequently poor both in the morning and evening during this season.

Occasionally in the hot months there is dust haze preceding a nor'wester.

Burma coast.—Fogs and mists are chiefly prevalent from October to February. At Rangoon visibility is usually poor in the evening during these months, and fogs occur on about 2 days a month in February and March. In the Irrawaddy delta the fogs are sometimes dense; it is said that often they do not clear until 1000.

Mist also forms sometimes on this coast during the South-west monsoon after rain.

Air temperature.—The average annual air temperature over the Bay is about 80° F. It is 2° or 3° below this on the northern shore, and 2° or 3° above over the sea and on the islands in the south, and also on parts of the east coast of the Indian peninsula. In the south, the average air temperature does not vary much from one month to another throughout the year, the range being only 2° or 3° over the sea and about 4° to 8° on the coasts. In the north, there is about 10° difference between the average temperature of the warmest and coolest months over the open sea, and from about 15° to 20° on the coasts.

The North-east monsoon season is the cool period everywhere, December and January being the coolest months. Over most of the region during this period the weather is fine and fresh with warm days but cool nights. On the northern and eastern shores the daily range of temperature is large, averaging over 20°; the range decreases to about 15° in the south-west, where, on the coasts, day maxima are about 85° and night minima about 70°. On the northern shore, in the cool months, night temperatures fall to 55° to 60°, and fires are often welcome in the evenings, though day temperatures reach from 75° to 80°. When western depressions pass, however, the weather in the north becomes cloudy and close for a few days. The warmest parts of the coast in this season are the Gulf of Martaban and the Tenasserim coast, where temperature frequently reaches 90° in the afternoon.

There is a general rise of temperature during February and March, which is only slight in the south but is rapid in the north; in fact, at Calcutta the average temperature for April is nearly 20° higher than for January. The period from March to May, or from April to early June, according to locality, constitutes the hottest season. The hottest shores are those which are exposed to the hot winds from the interior, in particular the east coast of India between Madras and Cocanāda and the Cuttack coast, where the day maxima average from 90° to 100°, and sometimes exceed 110°. The coolest regions are the south, and the islands and coasts well exposed to the sea. Over the open sea the temperature is about 84° or 85° in April and May.

When the South-west monsoon breaks, day temperatures are lower

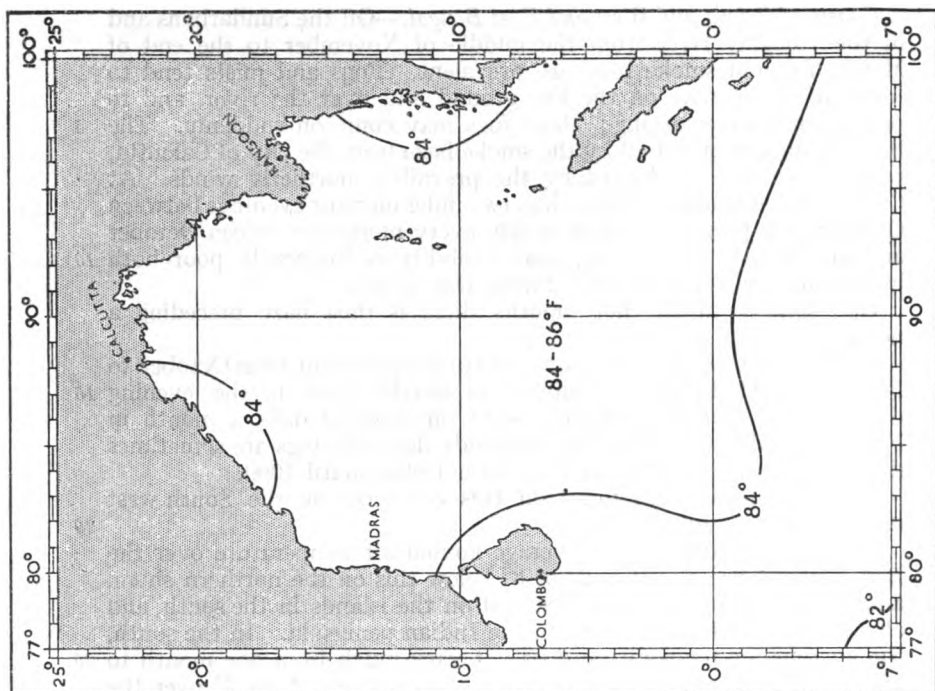


Fig. 18.—May

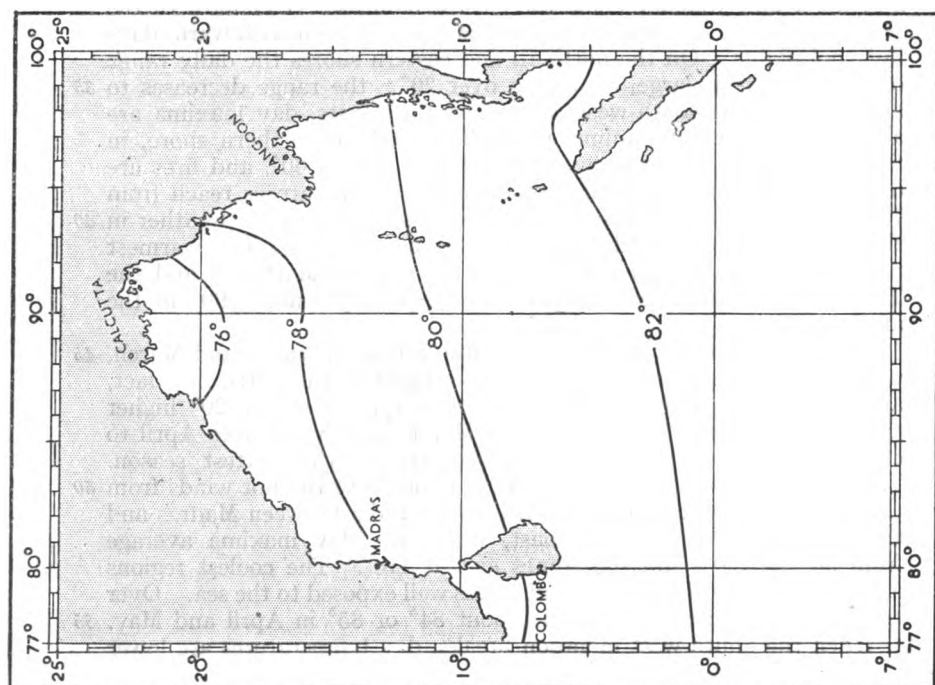


Fig. 17.—January

MEAN SEA SURFACE TEMPERATURE

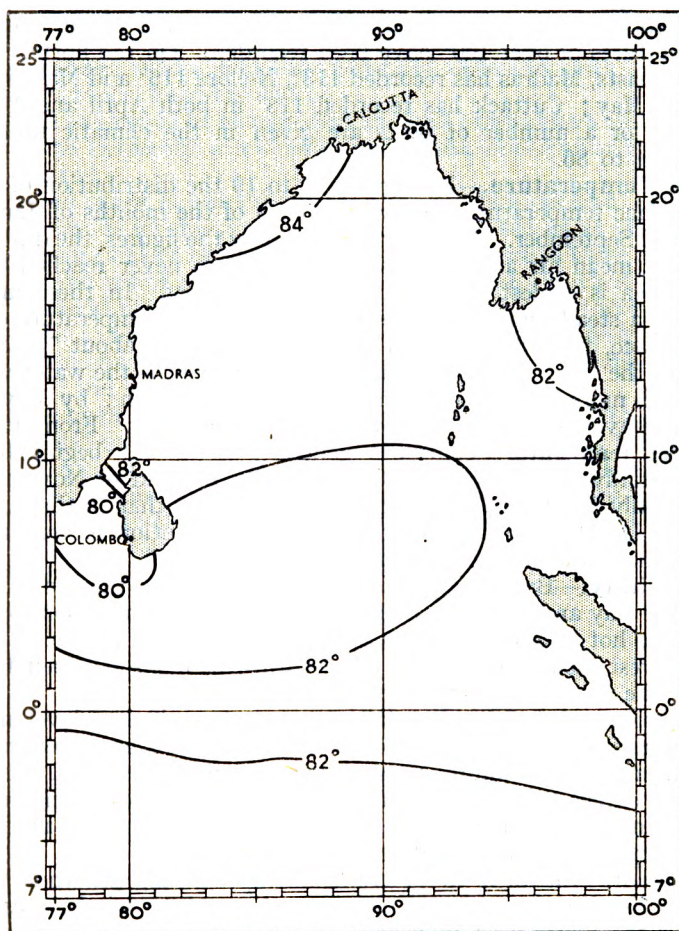


Fig. 19.—September
MEAN SEA SURFACE TEMPERATURE

on most of the coasts but the nights are still as warm, the daily range on many parts of the coast being only 10° to 12° . The weather is damp and oppressive. The temperature falls slightly in the course of the monsoon period and, by October, it ranges between 85° and 90° by day and from 73° to 78° at night over the whole stretch of coast. By November the weather in most districts becomes appreciably cooler and fresher.

The highest maximum temperatures are reached in the months from April to June, when everywhere on the coasts of the mainland temperatures of over 100° have been recorded. On the hottest parts of the coasts, Madras has recorded 113° , Nellore 116° and Masulipatan 118° in May; Cuttack has recorded 118° in both April and May.

Data for a number of ports are given in the climatic tables on pages 70 to 86.

Sea Temperature.—In Figures 17 to 19 the distribution of mean sea surface temperature is shown for each of the months of January, May and September. In the area covered by the figures, the difference between mean air and mean sea temperatures never reached 3° F.

The sea is coolest from December to January. In these months there is a steady northward decrease of the mean temperature of the sea surface, from 80° F. to 81° F. in the south to about 75° at the head of the Bay. During the following four months the water warms up much more rapidly in the north than in the south; by May temperature averages 80° to 85° over the Bay generally. From June to October temperature continues generally high, but begins to fall substantially in the north in October. By the end of November it is normally 2° or 3° colder at the head of the Bay than in the extreme south. By the middle of December the distribution is very nearly again that of January and February.

Humidity.—Broadly speaking, the period when the air is driest over the Bay and its shores is that of the North-east monsoon together with the hot season (March to May or June) before the onset of the South-west monsoon. During the South-west monsoon itself the air is for the most part very humid.

Occasions when humidity falls to an extremely low level mostly occur during the North-east monsoon and the hot season, generally in the afternoon. Mountain ranges, however, modify coastal winds to such an extent that one part of the coast is often experiencing onshore winds and only a moderate degree of dryness while an adjacent part is getting a scorching wind from the mainland.

At Madras the air is on an average damper during the whole period of the North-east monsoon, owing to the onshore winds, than it is during the South-west monsoon.

In Ceylon, during the North-east monsoon, the northern and eastern coasts are damper than the south-west coast.

During periods of cloud and rain, especially those that are associated with onshore winds, relative humidity is generally only slightly higher at night than it is during the day.

Averages of relative humidity at various hours for a number of ports are given in the climatic tables on pages 70 to 86.

CLIMATIC TABLES.—The tables that follow give statistics for several land stations. The figures given are averages, percentage frequencies or extremes, as stated; it must be realised that these values refer to the actual positions in which the weather has been observed, and *not* necessarily to the open sea or to the approaches to

ports in the vicinity. The tables should therefore be consulted with discretion, since all the elements are affected, some a great deal, by local conditions. The following notes indicate ways in which conditions over the open sea may differ from those at the nearest reporting land station.

- (1) Temperature at sea is less variable than over the land; for example the nights are generally warmer at sea and the days cooler, than over the land.
- (2) Rainfall at most stations in this area is affected by mountain ranges, whose influence generally decreases with increasing distance from the land.
- (3) The frequency of cloudy days on land often differs widely from the frequency a few miles out at sea, and similarly for clear days.
- (4) Wind speed is generally greater at sea than on land, and there may be several times as many gales at sea as at the nearest shore station, if the shore station is sheltered in those directions from which most of the gales blow at sea. Such a difference would not exist if the shore station were in an open position on a headland or low lying island devoid of shelter. Wind direction may also be greatly affected (*see* "Local modification of the weather near the coast," page xlv).
- (5) The open sea is rarely affected by the fogs which often form on land during the night when the sky is clear and the wind is light. In the area covered by this volume such night fogs do, however, sometimes extend some miles seaward, especially those which form near large towns and estuaries at the head of the Bay during the North-east monsoon.

PLACE—COLOMBO. LAT. 6° 54' N., LONG. 79° 52' E. Height above Mean Sea Level, 24 feet.
Climatic Table compiled from 20 to 40 Years' Observations, 1911 to 1952.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE			Relative humidity	SKY No. of days	RAIN Average fall No. of days with 0.04 in. or more	WIND DIRECTION																Mean wind speed	No. of days with wind speed 8 knots or more	No. of days with fog or mist †						
		Daily max.	Daily min.	Highest in each month				Lowest in each month	0030								1530										0030	1530				
									Percentage of observations from																							
									N.	NE.	E.	SE.	S.	SW.	W.	N.W.	Calm	N.	NE.	E.	SE.	S.	SW.						W.	NW.	Calm	
January	mb.	86	72	90	67	73	67	%	6	9	9	5	3	1	1	1	4	6	21	17	0	0	1	7	13	39	1	5.4	7.5	1	4	
February	1011	87	72	95	67	71	66	%	7	8	9	8	8	2	4	2	7	14	6	4	2	0	0	1	11	33	45	0	3.6	7.8	1	4
March	1010	88	74	91	70	72	74	%	10	13	9	10	12	6	12	7	14	2	2	2	2	0	0	1	25	45	25	0	3.0	7.6	1	4
April	1009	87	76	90	72	78	76	%	4	1	1	13	10	28	10	6	13	1	1	1	1	1	2	5	41	35	12	2	3.5	6.9	1	1
May	1008	87	78	89	72	78	76	%	1	0	2	13	10	28	10	6	13	4	1	1	1	1	2	6	65	20	3	1	5.6	7.1	1	0
June	1009	85	77	86	73	79	77	%	0	0	2	13	10	28	10	6	13	2	0	0	0	0	4	66	25	4	1	6.5	7.2	7	0	
July	1009	85	77	86	73	79	77	%	0	0	2	13	10	28	10	6	13	2	0	0	0	0	4	66	25	4	1	6.5	7.2	7	0	
August	1010	85	77	86	73	79	77	%	0	0	0	1	4	64	25	5	1	3	2	0	0	0	0	4	58	32	5	1	6.1	6.9	4	0
September	1010	85	77	87	73	76	75	%	0	0	1	3	4	63	23	4	2	1	0	0	0	0	3	64	29	3	0	6.3	7.3	3	0	
October	1010	85	75	83	70	77	75	%	2	6	3	5	5	42	19	8	10	13	10	4	1	1	2	3	20	28	31	1	4.6	6.5	3	2
November	1010	85	73	88	70	77	75	%	11	18	13	9	4	10	8	10	13	10	14	1	1	1	2	20	28	31	2	3.8	6.2	3	3	
December	1011	86	72	89	68	74	69	%	21	21	5	6	3	1	1	1	5	7	22	16	1	1	2	7	13	37	1	5.4	7.3	2	4	
Means	1010	86	75	92*	65**	76	73	—	6	20	4	6	4	34	14	5	7	5	4	0	1	3	40	28	18	1	5.0	7.1	—	—	—	20
Totals	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	34
Extreme values	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	30	25						30						30						30						20		25				

Standard of time : 82½° E. meridian.

* Mean of highest each year } in 20 years' observations.

** Mean of lowest each year }

† Highest recorded temperature.

†† Lowest recorded temperature.

‡ Undefined.

Authorities :—MS. data supplied by Department of Meteorology, Colombo.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—TRINCOMALEE. LAT. 8° 35' N., LONG. 81° 15' E. Height above Mean Sea Level, 24 feet.
Climatic Table compiled from 10 to 80 Years' Observations, 1871 to 1952.

MONTH	PRES- SURE at M.S.L. Mean	AIR TEMPERATURE Mean of				Relative humidity 0930 1530	SKY No. of days	RAIN		WIND DIRECTION										Mean wind speed	No. of days with speed 33 knots or more	No. of days with fog or mist ‡										
		Daily max.	Daily min.	Highest in each month	Lowest in each month			Average fall	No. of days with 0.04 in. or more	Percentage of observations from																						
										0930													1530									
										N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	N.				NE.	E.	SE.	S.	SW.	W.	NW.	Calm		
January	mb. 1012	° F. 80	° F. 75	° F. 83	° F. 71	% 78	in. 6.8	10	21	48	11	2	5	8	3	3	2	2	8	27	56	12	2	4	0	0	1	1	6.6	7.6	0	
February	1012	82	76	86	72	70	2.6	4	12	32	19	5	16	6	4	2	1	15	15	9	50	30	4	0	0	0	1	1	4.7	6.0	0	
March	1010	85	76	89	72	70	1.9	4	4	15	15	11	18	14	4	2	1	20	9	34	47	8	0	0	0	1	1	3.1	6.0	0		
April	1009	89	78	95	74	69	2.3	5	2	3	5	0	19	32	13	4	1	17	3	15	55	15	5	4	1	1	1	3.8	6.9	1		
May	1006	92	79	96	74	67	2.7	6	2	0	1	1	5	59	29	0	4	1	4	1	3	23	10	2	1	1	1	9.0	8.8	3		
June	1006	92	78	95	76	65	1.1	2	0	0	0	0	59	40	1	0	1	0	4	1	4	6	2	1	1	1	1	12.5	11.6	0		
July	1006	92	79	96	74	65	2.0	3	0	0	0	0	59	39	0	0	1	0	0	1	4	7	2	1	1	1	1	11.8	10.8	3		
August	1007	92	77	96	73	65	4.2	6	0	0	0	0	2	58	38	0	0	5	7	10	23	6	0	1	2	2	2	10.9	9.4	3		
September	1007	92	77	96	73	65	4.2	6	0	0	0	1	4	58	34	1	2	6	10	23	6	0	1	40	23	1	1	9.7	8.2	0		
October	1009	88	76	94	72	69	1.3	2	3	2	2	1	5	44	30	2	11	12	21	21	5	4	2	1	8	3	3	6.0	6.3	1		
November	1010	84	75	89	71	80	1.7	12	16	5	3	5	21	16	5	17	23	32	14	4	2	1	1	18	15	3	5	4.4	6.0	0		
December	1011	81	75	85	71	80	14.3	25	38	10	3	2	5	4	3	10	35	47	10	2	1	1	1	1	1	2	1	6.3	7.7	0		
Means . . .	1009	77	77	97*	69**	71	—	—	6	13	6	3	6	35	21	1	9	12	23	21	5	1	20	15	1	2	7.4	7.9	—	—	—	
Totals . . .	—	—	—	—	—	—	64.9	91	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Extreme values	—	—	—	99†	65††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
No. of years' observations	30	25				30		80										10		25												

Standard of time : 82½° E. meridian.

† Highest recorded temperature.

†† Lowest recorded temperature.

* Mean of highest each year } in 11 years' observations.
** Mean of lowest each year }

‡ Undefined.

Authorities :—MS. data supplied by Department of Meteorology, Colombo.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—COCANĀDA. LAT. 16° 57' N., LONG. 82° 14' E. Height above Mean Sea Level, 26 feet.
Climatic Table compiled from 5 to 60 Years' Observations, 1880 to 1940.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE Mean of			Cloud amount Scale 0—10	RAIN		WIND DIRECTION												Mean wind speed	No. of days with wind force 8 or more, Beaufort scale	No. of days with visibility less than ½ m. mile							
		Daily max.	Daily min.	Highest in each month		Lowest in each month	0800	1700	0800						1700														
									Percentage of observations from																				
									N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	N.	NE.				E.	SE.	S.	SW.	W.	NW.	Calm
January	mb.	81	66	87	71	0.5	26	31	1	0	0	0	1	15	26	0	6	23	64	5	1	0	0	1	1	4	6	0	0.5
February	1015	86	70	93	68	0.6	16	16	3	2	4	2	11	15	35	0	6	4	70	15	3	0	0	1	1	3	6	0	0
March	1011	92	73	98	63	0.7	6	3	2	7	2	11	15	12	45	0	1	1	44	36	17	0	0	0	1	3	6	0	0
April	1008	96	79	102	73	0.8	1	3	1	6	5	34	18	5	21	0	3	4	23	45	27	0	2	1	1	4	6	0	0
May	1004	99	82	109	75	74	0	4	3	3	1	37	40	5	14	0	0	1	25	37	19	3	3	6	6	6	0	0	0
June	1001	97	81	107	75	64	0	1	1	1	1	37	45	5	13	0	0	1	11	15	35	23	7	8	5	5	5	0	0
July	1002	90	78	98	74	6.5	1	0	0	0	0	35	45	5	14	0	0	0	4	45	35	9	6	5	5	5	5	0	0
August	1003	90	78	96	74	5.6	1	1	1	1	1	37	42	5	14	1	0	2	20	4	36	12	9	12	5	5	5	0	0
September	1005	90	78	95	74	6.2	4	4	1	1	0	22	31	9	27	0	19	22	25	2	14	5	6	0	2	5	6	0	0.1
October	1009	88	76	93	71	8.5	4	25	2	1	0	9	16	29	0	33	25	29	29	11	0	0	0	1	0	5	6	0	0.2
November	1012	83	72	87	65	74	4	25	50	2	1	0	6	1	9	12	0	13	25	29	11	0	0	0	1	0	5	7	0
December	1015	81	66	84	62	0.7	37	35	1	0	0	0	0	9	18	0	7	12	56	30	0	1	0	0	1	0	5	7	0
Means	1008	89	75	111*	60**	—	11	15	1	2	1	18	19	10	23	0	7	12	29	15	20	9	4	4	4	6	6	0.2	1.3
Totals	—	—	—	—	—	41.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Extreme values	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	50	45			32	7	60	60	20						5						10						5	10	—

Standard of time : 82½° E. meridian.

† Highest recorded temperature.

†† Lowest recorded temperature.

* Mean of highest each year.

** Mean of lowest each year.

ø Local time.

Authorities :—MS. data supplied by Director, India Meteorological Dept., New Delhi.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—VIZAGAPATAM. LAT. 17° 42' N., LONG. 83° 18' E. Height above Mean Sea Level, 126 feet.
Climatic Table compiled from 5 to 50 Years' Observations, 1872 to 1940.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE		Relative humidity	Cloud amount Scale 0—10	RAIN		WIND DIRECTION																Mean wind speed	No. of days with wind force 8 or more, Beaufort scale	of days with visibility less than ½ m. mile																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		Mean of				Average fall	No. of days with 0-1 in. or more	0800								1700																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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								Highest in each month	Lowest in each month	0800	1700	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	N.	NE.	E.	SE.	S.		SW.	W.	NW.	Calm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		° F.	° F.	%	%	In.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

Standard of time : 82½° E. meridian.

* Mean of highest each year.

** Mean of lowest each year.

† Highest recorded temperature.

†† Lowest recorded temperature.

§ Local time.

Authorities :—MS. data supplied by Director, India Meteorological Dept., New Delhi.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—PURI. LAT. 19° 48' N., LONG. 85° 49' E. Height above Mean Sea Level, 20 feet.
Climatic Table compiled from 5 to 50 Years' Observations, 1889 to 1940.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE Mean of			Relative humidity	Cloud amount Scale 0-10	RAIN Average fall No. of days with 0.1 in. or more	WIND DIRECTION																		No. of days with wind force 8 or more, Beaufort scale	No. of days with visibility less than 1/2 n. mile	
		Daily max.	Daily min.	Highest in each month				Percentage of observations from 0800						Percentage of observations from 1700						Mean wind speed								
								0800						1700														
								N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	N.	NE.	E.		SE.	S.	SW.	W.	NW.			Calm
January	mb.	80	64	84	57	80	55	14	0	0	1	6	3	11	10	1	3	15	29	40	12	0	0	0	6	8	1	
February	1016	83	69	88	61	79	32	15	1	0	3	19	7	9	13	1	8	8	23	41	23	0	1	7	11	0	0.9	
March	1011	86	76	91	68	83	11	5	1	0	7	51	6	5	14	1	1	1	11	50	34	1	1	9	13	0	0.9	
April	1007	88	79	93	73	83	1	1	1	1	14	69	6	1	4	0	0	0	5	52	41	2	0	12	15	0	0.1	
May	1004	90	81	94	73	84	1	1	1	1	19	64	4	1	8	3	1	0	7	44	39	3	0	13	15	0	0.4	
June	1000	89	81	94	74	84	6	2	1	1	12	51	11	3	13	1	1	0	3	39	41	10	2	8	11	0	0.4	
July	1000	87	80	93	75	85	8	4	0	1	5	52	13	5	12	2	0	0	3	35	42	8	3	12	14	0	0.6	
August	1001	88	80	93	75	83	12	8	0	1	7	43	14	7	17	3	1	1	5	38	36	10	2	4	10	12	0	0.6
September	1005	89	80	93	75	83	16	6	2	3	10	24	9	8	22	3	2	1	5	36	31	9	4	3	7	10	0	0.6
October	1010	89	77	93	71	80	40	10	2	2	8	5	11	19	17	11	19	11	10	15	22	5	1	1	6	6	0.1	
November	1013	85	69	89	63	75	66	16	1	0	1	1	0	10	5	23	21	11	15	28	10	1	1	2	6	6	0.1	
December	1016	81	63	84	57	75	70	10	0	0	0	1	0	10	3	14	8	21	24	24	6	0	0	3	6	7	0	0.5
Means	1008	86	75	97*	56**	81	26	8	1	1	7	32	6	7	12	6	4	6	13	37	27	4	1	2	9	11	—	—
Totals	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—
Extreme values	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	—	—	50	50	5	32	7	50	50	20	20	5	5	5	5	5	5	5	5	5	5	5	5	5	10	5	10	—

Standard of time : 82½° E. meridian.

† Highest recorded temperature.
†† Lowest recorded temperature.

* Mean of highest each year.
** Mean of lowest each year.

Local time.

Authorities :—MS. data supplied by Director, India Meteorological Dept., New Delhi.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—SĀGAR ISLAND. LAT. 21° 39' N., LONG. 88° 03' E. Height above Mean Sea Level, 10 feet.
Climatic Table compiled from 5 to 60 Years' Observations, 1869 to 1940.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE			Relative humidity	Cloud amount Scale 0-10	RAIN	WIND DIRECTION										Mean wind speed	No. of days with wind force 8 or more, Beaufort Scale	No. of days with visibility less than ½ m. mile											
		Daily max.	Daily min.	Mean of each month				0800			1700			Percentage of observations from																	
								Highest in each month	Lowest in each month	0800	1700	0800	1700	Percentage of observations from																	
														N.	NE.	E.	SE.				S.	SW.	W.	NW.	Calm	N.	NE.	E.	SE.	S.	SW.
January	mb. 1015	° F. 77	° F. 59	° F. 82	° F. 51	° F. 51	35	26	4	2	7	9	6	10	1	26	11	1	7	38	12	1	2	2	2	0	7	5	0	3	
February	1013	81	65	86	54	54	21	19	4	2	14	20	9	10	1	13	5	8	51	15	0	4	2	2	0	6	11	0	7	3	
March	1010	87	74	93	64	74	8	4	1	2	28	40	10	7	0	3	2	8	66	18	1	0	1	0	1	9	18	0	0	0	
April	1007	90	79	93	71	78	2	3	1	5	49	37	3	2	0	0	0	5	72	22	1	1	1	0	1	13	16	2	0	1	
May	1003	91	84	94	72	75	2	3	3	10	49	28	3	2	1	2	1	3	19	46	22	5	2	0	0	11	13	0	0	0	
June	999	90	81	94	75	81	2	6	5	8	38	32	5	3	1	2	1	3	14	46	27	6	1	1	0	11	13	0	0	0	
July	998	90	81	94	75	81	2	6	5	7	38	32	5	3	1	2	1	3	14	46	27	6	1	1	0	11	13	0	0	0	
August	1000	87	80	91	76	85	3	6	7	12	33	34	10	4	1	5	3	16	45	26	6	4	3	3	8	7	5	0	0	0	
September	1004	88	79	91	75	85	4	10	10	11	26	24	10	4	1	14	13	10	43	21	14	3	3	8	7	5	0	0	0	0	
October	1009	87	76	90	70	81	18	19	10	5	9	14	11	13	1	14	15	12	21	14	3	3	8	7	5	0	0	0	0	0	
November	1013	82	67	87	60	78	42	31	3	1	2	4	4	13	0	32	28	3	13	10	3	3	8	7	5	0	0	0	0	0	
December	1015	77	59	81	52	64	53	24	2	1	1	4	4	11	0	47	17	2	17	8	2	5	4	1	7	5	0	0	0	0	
Means . . .	1007	85	73	97*	51**	5.9	16	13	5	6	22	23	7	7	1	12	7	3	10	44	17	3	2	2	9	10	—	—	—	—	13
Totals . . .	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	13
Extreme values	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	13
No. of years' observations	50	60						24						5						10											

Standard of time : 82½° E. meridian.

* Mean of highest each year.

** Mean of lowest each year.

† Highest recorded temperature.

†† Lowest recorded temperature.

g Local time.

Authorities :—MS. data supplied by Director, India Meteorological Dept., New Delhi.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—CALCUTTA. LAT. 22° 32' N., LONG. 88° 20' E. Height above Mean Sea Level, 21 feet.
Climatic Table compiled from 5 to 60 Years' Observations, 1881 to 1940.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE Mean of			Relative humidity	Cloud amount Scale 0—10	RAIN		WIND DIRECTION												Mean wind speed	No. of days with wind force 8 or more, Beaufort scale	No. of days with visibility less than ½ m. mile								
		Daily max.	Daily min.	Highest in each month			Lowest in each month	Average fall	No. of days with 0.1 in. or more	0800						1700															
										Percentage of observations from						Percentage of observations from															
										N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm				
January	mb.	80	55	84	49	51	2.3	0.4	in.	26	8	3	4	5	5	11	36	14	0	1	3	7	3	5	4	18	52	1	0.2	9	
February	1015	84	59	90	52	48	2.7	1.2	1.2	17	9	4	7	14	9	11	26	14	3	3	7	8	11	15	11	20	23	2	0.2	3	
March	1010	93	69	99	61	45	2.9	2.4	1.4	6	3	3	6	33	8	13	13	6	1	1	1	3	22	29	6	15	15	3	0.4	0	
April	1006	97	75	103	68	48	3.7	3.2	1.7	2	4	4	8	35	41	4	2	2	0	0	3	35	38	2	3	5	5	6	2	0	
May	1003	96	77	103	70	77	4.7	4.2	5.5	2	3	10	14	38	26	3	1	3	1	3	9	13	36	18	1	3	5	4	4	0	
June	999	92	79	90	74	82	7.5	7.6	11.7	2	3	13	17	31	25	8	2	3	1	3	7	23	39	18	1	3	5	4	4	0	
July	999	89	79	93	75	86	8.6	8.8	12.8	1	3	15	19	25	22	7	3	2	1	1	4	17	38	29	3	0	8	4	4	0	0
August	1001	89	78	92	75	88	8.5	8.7	12.9	18	2	4	16	19	25	22	7	3	2	1	3	17	38	29	3	0	8	4	4	0	0
September	1005	90	78	93	75	86	80	6.9	9.9	2	3	4	16	20	20	8	4	5	2	5	12	19	26	2	4	12	30	3	0.2	0.1	
October	1009	89	74	92	68	85	75	3.7	4.5	9	10	8	8	14	10	10	14	9	3	6	8	10	8	1	5	50	2	2	0	0.3	
November	1013	84	64	87	58	70	63	2.2	0.8	41	7	1	2	2	5	14	21	13	2	1	1	1	1	1	0	12	69	1	0	2	0
December	1016	79	55	82	50	80	59	1.9	0.2	42	7	1	1	2	4	15	27	16	1	0	0	0	0	1	0	12	69	1	0	4	0
Means	1007	89	70	104*	49**	82	65	4.6	—	14	5	8	10	18	19	6	7	13	7	2	3	9	20	18	4	8	29	3	3	5	—
Totals	—	—	—	111†	44††	—	—	—	63.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	25
Extreme values	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	50	60						20	27						5						10						5		10		

Standard of time : 82½° E. meridian.

† Highest recorded temperature.
†† Lowest recorded temperature.

* Mean of highest each year.
** Mean of lowest each year.

s Local time.

Authorities :—MS. data supplied by Director, India Meteorological Dept., New Delhi.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—AKYAB. LAT. 20° 08' N., LONG. 92° 55' E. Height above Mean Sea Level, 29 feet. Climatic Table compiled from 5 to 60 Years' Observations, 1872 to 1940.

[illegible]

Standard of time: 82½° E. meridian.

† Highest recorded temperature.

†† Lowest recorded temperature.

* Mean of highest each year.
** Mean of lowest each year.

*** Mean of lowest each year.

Authorities:—MS. data supplied by Director, India Meteorological Dept., New Delhi.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—TABLE ISLAND, COCO GROUP. LAT. 14° 11' N., LONG. 93° 22' E. Height above Mean Sea Level, 90 feet.
Climatic Table compiled from 5 to 30 Years' Observations.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE Mean of				Relative humidity		RAIN		WIND DIRECTION								Mean wind speed	No. of days with gale	\$ No. of days with fog	
		Daily max.	Daily min.	Highest in each month	Lowest in each month	0800	0800	Average fall	No. of days with 0.1 in. or more	Percentage of observations from											
										N.	NE.	E.	SE.	S.	SW.	W.	NW.				Calm
January	mb. 1015	° F. 83	° F. 75	° F. 85	° F. 72	% 74	4.4	0.8	0.7	35	34	18	2	1	0	0	3	7	6	0	
February	1014	84	77	87	72	76	3.6	0.1	0.3	52	20	6	1	0	1	2	13	5	6	0	
March	1013	87	77	90	73	78	3.5	0.2	0.3	41	10	4	1	2	5	5	29	6	5	0	
April	1011	89	79	92	76	75	4.0	0.6	1	21	4	4	4	3	21	15	15	7	9	1	
May	1008	89	80	93	73	81	6.6	8.7	11	4	1	2	0	3	30	27	1	4	1	0	
June	1006	86	78	89	72	89	8.1	15.1	17	0	0	0	1	1	53	18	1	1	13	0	
July	1006	85	77	87	73	91	8.4	13.5	18	1	0	1	1	1	47	19	3	1	15	0	
August	1007	84	77	87	73	90	8.0	11.5	16	0	0	2	4	16	37	28	6	6	10	0	
September	1008	84	77	87	73	88	7.4	11.3	16	1	0	16	13	15	14	10	5	11	6	0	
October	1011	85	78	88	73	84	6.1	6.5	10	6	8	26	32	10	8	4	3	2	7	0	
November	1012	85	78	87	74	81	5.8	5.7	7	8	26	32	10	8	4	0	1	0	0	0	
December	1013	83	77	86	73	75	5.3	2.4	2	22	39	29	5	2	0	0	2	2	0	0	
Means	1010	85	77	—	—	82	5.9	—	—	16	12	10	4	9	22	13	9	5	9	—	
Totals	—	—	—	—	—	—	—	76.4	99	—	—	—	—	—	—	—	—	—	—	—	
Extreme values	—	—	—	96†	65††	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
No. of years' observations	—	—	—	15	15	15	15	30	30	15	15	15	15	15	15	15	15	15	25	5	

Hour of observation : 0800 (local time).

† Highest recorded temperature.

†† Lowest recorded temperature.

‡ Mean of 24 hours.
§ Days on which visibility falls below ½ nautical mile at any time of day.
|| Observations at 0800 (local time).

Authorities :—MS. data supplied by Ind. Met. Dept.,
Poona, Scientific Notes, 6, No. 63, 1935.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—PORT BLAIR. LAT. 11° 40' N., LONG. 92° 43' E. Height above Mean Sea Level, 261 feet.
Climatic Table compiled from 5 to 60 Years' Observations, 1881 to 1940.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE			Relative humidity	CLOUD amount Scale 0-10	RAIN	WIND DIRECTION																		Mean wind speed	No. of days with wind force 8 or more, Beaufort scale	No. of days with visibility less than 1/2 m. mile																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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January	mb.	84	72	88	67	74	74	37	13	6	5	1	0	0	2	12	6	19	56	18	1	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Standard of time : 82½° E. meridian.

† Highest recorded temperature.

†† Lowest recorded temperature.

* Mean of highest each year.

** Mean of lowest each year.

Authorities :—MS. data supplied by Director, India Meteorological Dept., New Delhi.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

Local time.

PLACE—CAR NICOBAR. LAT. 9° 15' N., LONG. 92° 48' E. Height above Mean Sea Level, 25 feet.
Climatic Table compiled from 5 to 23 Years' Observations, 1897 to 1920 and 1935 to 1939.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE Mean of				Relative humidity		RAIN		WIND DIRECTION										Mean wind speed	No. of days with gale	§ No. of days with fog
		Daily max.	Daily min.	Highest in each month	Lowest in each month	0800	Scale 0—10	Average fall	No. of days with 0.1 in. or more	Percentage of observations from												
										0800												
										N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm				
January	mb.	85	77	87	72	78	6.4	4.1	4	25	47	12	7	2	1	1	2	3	—	0	0	
February	1011	87	77	89	72	77	8.0	1.1	2	22	49	15	7	1	0	0	2	3	—	0	0	
March	1012	89	77	91	73	78	8.0	1.4	2	24	42	13	6	1	0	0	5	3	—	0	0	
April	1010	90	77	93	74	81	8.6	3.1	5	15	19	3	15	5	6	4	7	26	—	0	0	
May	1009	87	77	91	74	89	8.9	12.8	14	4	3	3	6	10	44	6	3	21	—	0	0	
June	1008	86	77	91	74	88	9.2	12.5	15	0	0	0	7	13	62	16	0	6	—	0	0	
July	1008	86	77	90	74	88	9.3	9.1	12	0	0	0	4	12	62	16	0	4	—	0	0	
August	1008	86	77	89	73	89	9.2	10.5	13	0	1	1	4	17	56	17	0	4	—	0.4	0	
September	1009	86	76	89	73	90	9.2	12.4	15	1	1	0	5	18	45	15	1	14	—	0	0	
October	1010	85	75	89	73	92	8.7	11.3	14	6	6	4	8	15	28	4	1	18	—	0	0	
November	1010	85	76	88	73	88	8.4	10.6	12	11	23	9	10	10	14	3	3	17	—	1	0	
December	1011	85	77	87	72	81	8.0	7.9	9	17	33	20	14	4	4	0	2	6	—	0.8	0	
Means	1010	87	77	94*	70**	85	8.5	—	—	10	18	7	8	9	27	7	2	12	—	—	—	
Totals	—	—	—	95†	66††	—	—	96.8	117	—	—	—	—	—	—	—	—	—	—	2	0	
Extreme values	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
No. of years' observations	13	10	13	13	23	13	13	23	13	13	13	13	13	13	13	13	13	13	—	5	5	

Hour of observation : 0800 (local time).

* Mean of highest each year.

** Mean of lowest each year.

† Highest recorded temperature.

†† Lowest recorded temperature.

§ Days on which visibility is $\frac{1}{2}$ nautical mile or less at any time of day.

Authorities :—MS. data supplied by Ind. Met. Dept.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—RANGOON. LAT. 16° 46' N., LONG. 96° 11' E. Height above Mean Sea Level, 18 feet.
Climatic Table compiled from 5 to 60 Years' Observations, 1878 to 1940.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE		Relative humidity	CLOUD amount Scale 0-10	RAIN No. of days with fall	WIND DIRECTION																		No. of days with wind force 8 or more, Beaufort scale	No. of days with visibility less than 1/4 m. mile																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		Daily max.	Daily min.				Highest in each month	Lowest in each month	0800						1700						Mean wind speed																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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									N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	N.	NE.	E.		SE.	S.	SW.			W.	NW.	Calm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
Mean		° F.	° F.	%	%	in.	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24	24-27	27-30	30-33	33-36	36-39	39-42	42-45	45-48	48-51	51-54	54-57	57-60	60-63	63-66	66-69	69-72	72-75	75-78	78-81	81-84	84-87	87-90	90-93	93-96	96-99	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
January	1011	80	65	63	3.0	2.9	22	27	7	6	3	7	9	8	11	14	6	2	12	18	10	12	14	12	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Standard of time : 82° E. meridian.

† Highest recorded temperature.

†† Lowest recorded temperature.

° Local time.

* Mean of highest each year.
** Mean of lowest each year.

Authorities :—MS. data supplied by Director, India Meteorological Dept., New Delhi.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PLACE—AMHERST. LAT. 16° 05' N., LONG. 97° 34' E. Height above Mean Sea Level, 71 feet.
Climatic Table compiled from 5 to 13 Years' Observations, 1928 to 1940.

[illegible]‡ Mean of day.
ø Local time.

**METEOROLOGICAL OFFICE,
AIR MINISTRY.**

Standard of time: 82½° E. meridian.

* Mean of highest each year.
** Mean of lowest each year.

Authorities:—MS. data supplied by Director, India Meteorological Dept., New Delhi.
Delhi, India Met. Dept., India Weather Review.

PLACE—MERGUI. LAT. 12° 26' N., LONG. 98° 36' E. Height above Mean Sea Level, 66 feet.
Climatic Table compiled from 5 to 60 Years' Observations, 1878 to 1940.

MONTH	PRES- SURE at M.S.L.	AIR TEMPERATURE Mean of		Relative humidity	CLOUD amount Scale 0-10	RAIN No. of days with Average fall 0.1 in. or more	WIND DIRECTION												Mean wind speed †	No. of days with wind force 8 or more, Beaufort scale	No. of days with visibility less than ½ m. mile							
		Daily max.	Daily min.				Percentage of observations from						Percentage of observations from															
							0800						1700															
							N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	N.	NE.	E.				SE.	S.	SW.	W.	NW.	Calm	
January	mb.	° F.	° F.	° F.	%	In.	2	1	25	27	36	1	0	0	1	7	26	10	6	6	2	3	1	44	2	0	0	
February	1010	87	69	92	72	3.8	1-0	1	8	29	56	36	0	0	0	0	6	10	8	2	11	2	4	1	62	0	0	
March	1009	89	71	93	65	3.7	2-1	5	15	28	44	2	0	0	0	1	10	11	10	5	9	1	3	1	59	1	0-2	
April	1008	90	73	95	72	2.7	4-9	6	17	23	37	3	2	1	3	9	10	11	4	9	3	7	4	49	3	0	0	
May	1007	91	75	95	72	3.3	5-2	4	16	19	49	6	8	2	3	6	2	4	7	22	8	5	7	18	6	0	0	
June	1006	89	75	94	72	6.4	16-7	18	4	15	44	13	11	3	5	4	3	3	4	19	13	35	7	8	5	4	0	
July	1006	85	74	92	71	6.6	30-0	25	1	6	18	43	9	20	5	3	5	5	2	4	15	10	43	8	5	4	0	
August	1006	84	73	89	71	6.8	32-9	26	1	6	8	32	6	8	30	5	3	3	4	15	10	43	8	5	4	0	0	
September	1007	84	73	89	71	6.3	30-0	26	1	8	6	37	9	21	3	6	9	3	2	5	19	12	30	7	14	8	4	0
October	1007	84	73	89	71	6.8	24-9	23	1	4	19	44	8	9	2	3	10	4	4	5	19	10	14	3	19	6	4	0
November	1008	86	73	90	66	5.0	6-1	12.1	3	23	25	28	4	3	2	2	10	8	11	10	10	14	3	19	5	4	0	0
December	1009	87	69	90	62	3.8	3-8	6	27	30	30	1	0	0	0	0	9	17	20	13	20	6	3	1	15	5	4	0-2
		87	69	90	62	4.4	0-8	2	40	27	23	2	0	0	0	0	2	23	26	10	8	1	1	2	26	3	0	0
Means	1008	87	72	96**	80	5.5	—	—	15	21	40	5	6	2	2	7	10	9	6	15	6	16	4	29	5	4	—	—
Totals	—	—	—	—	—	162.3	157	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0-4
Extreme values	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	50	60	60	50	5	60	60	60	60	60	60	60	60	60	60	5	43	4	—	—	—	—	—	—	—	—	—	5

Standard of time : 82½° E. meridian.

* Mean of highest each year.

** Mean of lowest each year.

† Highest recorded temperature.

‡ Lowest recorded temperature.

† Mean of 24 hours.

‡ Local time.

Authorities :—MS. data supplied by Director, India Meteorological Dept., New Delhi.

METEOROLOGICAL OFFICE,
AIR MINISTRY.

PERCENTAGE FREQUENCY OF WIND DIRECTION AT COAST STATIONS.

Month	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.
	0930 I.S.T. Galle.									0800 I.S.T. Hambantota.								
January	17	20	20	3	3	3	7	10	17	13	79	2	0	0	0	1	1	3
February	12	22	29	4	4	4	7	7	11	13	79	3	0	0	0	1	1	2
March	10	20	23	7	7	7	7	10	13	11	54	7	2	1	10	5	3	7
April	6	10	13	3	6	10	23	19	10	8	19	5	2	2	31	20	6	7
May	3	3	3	0	3	16	44	25	3	1	1	0	0	0	57	37	1	2
June	0	0	0	0	0	7	60	33	0	0	0	0	0	0	56	42	2	0
July	0	0	0	0	0	3	56	41	0	0	0	0	0	0	56	41	3	0
August	0	0	0	0	0	7	50	43	0	0	0	0	0	0	57	40	3	0
September	4	0	0	0	0	7	53	36	0	0	0	0	0	1	63	34	2	0
October	6	3	3	3	0	10	43	29	3	4	6	3	1	2	46	29	4	5
November	13	10	10	3	3	3	17	28	13	9	31	3	1	1	17	19	8	11
December	20	17	17	3	3	3	7	13	17	15	63	3	0	1	3	3	5	7
Annual mean	8	9	10	2	2	6	31	25	7	6	28	2	0	1	33	23	3	4
No. of years	30									30								
	1530 I.S.T.									1700 I.S.T.								
January	3	3	3	7	10	17	34	20	3	2	30	49	8	5	5	1	0	0
February	0	4	4	7	19	22	29	15	0	0	10	57	22	6	4	1	0	0
March	3	3	6	6	19	23	27	13	0	0	6	37	21	15	20	0	0	1
April	3	3	3	7	10	17	34	20	3	1	2	10	12	11	55	8	1	0
May	3	0	0	0	3	17	50	27	0	0	0	0	1	4	74	20	1	0
June	0	0	0	0	0	7	57	36	0	0	0	0	0	0	66	31	3	0
July	0	0	0	0	0	4	50	46	0	0	0	0	0	0	59	36	5	0
August	0	0	0	0	0	3	52	45	0	0	0	0	0	0	70	27	3	0
September	0	0	0	0	3	7	51	39	0	0	0	0	0	1	77	19	3	0
October	4	0	0	0	4	11	49	32	0	1	1	2	4	8	64	18	2	0
November	3	3	3	3	7	13	34	31	3	2	7	13	11	12	41	11	1	2
December	3	3	6	6	9	15	34	18	6	2	22	35	12	11	14	2	1	1
Annual mean	2	2	2	3	7	13	42	28	1	1	6	17	8	6	46	14	2	0
No. of years	30									30								
	0930* I.S.T. Little Basses.									1530* I.S.T.								
January	75	13	2	1	0	1	1	1	3	35	54	4	3	2	1	0	1	0
February	71	14	2	0	0	2	2	0	2	18	67	9	3	3	0	0	0	0
March	47	14	1	1	1	5	8	11	3	6	52	15	7	12	6	1	0	1
April	9	4	1	1	4	31	31	9	10	1	12	7	25	38	6	2	0	0
May	2	0	0	0	0	86	14	0	0	0	0	0	0	90	10	0	0	0
June	0	0	0	0	0	80	20	0	0	0	0	0	0	80	6	2	0	0
July	0	0	0	0	0	86	13	1	0	0	0	0	0	78	14	1	1	0
August	0	0	0	0	0	85	10	0	3	0	1	0	0	88	8	1	0	0
September	0	0	0	0	0	85	10	0	3	0	0	0	0	89	5	0	0	0
October	8	3	1	0	2	85	10	0	5	2	5	4	3	10	9	3	3	4
November	31	8	2	1	1	12	20	16	9	12	26	7	4	11	24	7	5	4
December	67	10	1	1	0	2	3	14	2	24	57	5	3	4	1	2	2	0
Annual mean	26	5	1	0	1	43	14	6	4	8	23	4	3	7	47	6	1	1
No. of years	9									9								

PERCENTAGE FREQUENCY OF WIND DIRECTION AT COAST STATIONS—continued.

Month	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.		
	0930 I.S.T. Batticaloa.				0800 I.S.T. Pamban.				0800 I.S.T. Negapatam.											
January	11	33	6	2	2	3	25	9	9	28	52	7	0	0	0	0	8	5		
February	6	22	9	2	3	4	28	11	15	13	46	18	2	1	0	0	1	19		
March	4	14	8	6	10	4	24	10	20	3	21	29	13	6	2	1	1	24		
April	4	12	9	10	13	6	18	8	20	1	5	12	28	22	13	1	1	17		
May	2	9	7	13	17	14	16	6	16	2	1	2	10	23	42	11	2	7		
June	1	5	7	10	13	20	24	5	15	0	0	0	3	18	57	16	1	5		
July	1	5	6	9	11	18	28	8	14	0	0	0	5	19	48	13	2	13		
August	2	7	6	9	13	15	24	9	15	2	1	2	7	25	28	11	2	22		
September	3	9	8	10	13	13	21	8	15	2	1	3	7	25	30	11	5	16		
October	3	10	6	6	11	10	25	9	20	12	6	4	8	19	20	9	8	14		
November	5	7	4	4	6	7	37	11	19	28	19	5	3	8	5	6	15	11		
December	10	19	4	1	2	3	36	12	13	43	23	3	1	1	1	2	23	3		
Annual mean	4	13	7	7	10	10	25	9	15	11	14	7	7	14	21	7	6	13		
No. of years	30				20				20				20				20			
	1530 I.S.T.				1700 I.S.T.				1700 I.S.T.				1700 I.S.T.				1700 I.S.T.			
January	26	54	9	3	0	0	1	5	2	38	56	4	0	0	0	0	2	0		
February	15	62	16	3	0	0	1	1	2	33	57	5	1	0	0	0	3	1		
March	6	47	34	10	1	0	0	1	1	19	26	9	17	21	4	1	2	1		
April	2	24	47	23	2	0	1	0	1	8	11	5	33	31	7	1	3	1		
May	1	12	47	27	3	4	9	1	1	1	0	0	28	50	19	1	1	0		
June	1	6	32	29	4	9	14	2	3	0	0	0	17	51	31	1	0	0		
July	1	6	31	28	4	10	15	4	1	0	0	0	21	50	26	3	0	0		
August	1	8	36	34	6	5	6	3	1	0	0	0	34	50	15	1	0	0		
September	1	6	37	36	6	4	6	2	2	0	0	0	43	42	11	0	0	0		
October	5	23	33	21	3	2	5	4	4	8	10	3	19	36	16	0	6	2		
November	16	35	20	8	2	2	6	7	4	30	33	3	7	12	3	3	7	2		
December	26	47	10	2	1	0	3	7	4	42	41	4	1	1	3	0	8	0		
Annual mean	8	28	29	19	3	3	5	3	2	15	20	3	18	28	11	1	3	1		
No. of years	30				5				5				5				5			

Standard of time : 82½° E. meridian.

PERCENTAGE FREQUENCY OF WIND DIRECTION AT COAST STATIONS—continued.

Month	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.									
	0800 I.S.T. Nellore.									0800 I.S.T. Masulipatam.									0800 I.S.T. Gwa.								
January	13	7	5	7	5	3	2	33	25	36	23	6	6	3	0	0	1	25	1	0	0	16	5				
February	5	2	5	16	22	7	3	14	26	19	15	7	18	10	1	0	1	29	1	2	0	16	15				
March	1	0	2	25	46	10	2	3	11	4	6	4	20	33	7	2	1	23	13	6	0	3	8				
April	1	1	1	18	56	16	3	1	3	1	1	1	20	48	18	3	1	7	24	8	1	4	4				
May	6	2	0	11	26	10	18	19	8	1	1	1	13	30	18	13	14	9	12	4	1	35	5				
June	5	1	0	1	6	11	41	31	4	2	0	0	3	5	8	34	42	6	2	0	2	41	8				
July	5	0	0	0	5	17	40	26	7	0	0	0	0	3	12	41	35	9	1	1	3	37	7				
August	3	0	0	1	4	17	39	30	6	1	0	0	0	3	12	39	35	10	3	3	3	27	5				
September	3	1	1	3	9	11	30	29	13	1	1	1	1	5	13	26	36	16	7	5	1	24	6				
October	10	6	4	7	11	6	10	25	21	18	14	4	5	5	4	9	17	24	2	1	3	23	3				
November	22	10	5	3	3	2	3	36	16	37	30	8	4	1	0	1	15	24	2	2	3	17	5				
December	26	9	3	1	1	2	1	37	20	40	31	8	3	0	0	0	1	17	2	2	1	14	2				
Annual mean	8	3	2	8	16	9	16	25	13	13	10	3	8	12	8	14	16	16	6	3	1	21	6				
No. of years	20									20									5								
	1700 I.S.T.									1700 I.S.T.									1700 I.S.T.								
January	1	15	78	6	0	0	0	0	0	0	3	19	65	11	1	0	1	0	1	1	1	2	0				
February	0	0	82	17	0	0	0	0	0	1	1	9	61	26	2	0	0	0	1	0	0	0	0				
March	0	0	66	34	0	0	0	0	0	0	0	1	52	40	7	0	0	0	0	0	0	0	0				
April	1	1	64	29	2	0	1	1	1	0	0	1	51	35	12	0	0	0	0	0	0	1	1				
May	1	1	42	29	5	3	14	3	2	2	1	0	45	30	11	5	6	0	1	1	1	17	5				
June	1	1	9	14	6	17	45	7	0	3	1	2	15	23	18	17	21	0	2	1	0	25	11				
July	1	0	3	3	1	24	54	12	2	2	1	2	4	9	26	21	35	0	2	0	0	15	9				
August	1	1	9	6	3	8	61	10	1	5	1	1	13	5	19	18	38	0	2	1	1	7	7				
September	2	3	32	12	5	4	29	11	2	5	5	1	20	11	15	13	30	0	5	3	2	9	11				
October	4	18	42	14	2	0	9	5	6	6	22	12	31	8	7	3	10	1	8	3	2	18	4				
November	7	51	29	4	0	0	1	1	7	11	23	15	35	5	2	2	6	1	8	2	3	6	1				
December	2	47	47	2	0	0	0	1	1	7	14	18	47	11	1	0	1	1	2	2	5	7	0				
Annual mean	2	12	41	14	2	5	18	4	2	3	6	7	37	18	10	7	12	0	3	1	1	9	3				
No. of years	5									5									5								

Standard of time : 82½° E. meridian.

PERCENTAGE FREQUENCY OF WIND DIRECTION AT COAST STATIONS—continued.

Month	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	C.
	0800 I.S.T. Tavy.									0800 I.S.T. Victoria Point.								
January	3	4	1	0	0	0	0	0	92	11	51	16	3	1	0	0	2	16
February	4	5	1	1	0	0	0	1	88	3	62	14	2	0	0	1	1	17
March	4	5	0	0	0	0	0	2	89	4	56	16	3	0	1	0	2	18
April	4	5	1	1	0	0	0	1	88	5	46	17	8	2	2	0	2	16
May	2	2	1	5	6	3	1	1	79	1	13	13	18	12	5	5	3	23
June	1	1	1	6	9	7	1	1	73	0	4	9	17	14	25	10	3	18
July	0	1	1	5	8	9	1	1	74	2	2	7	13	9	33	13	3	18
August	1	0	0	4	5	4	1	1	75	1	3	4	8	15	9	17	10	4
September	1	1	0	4	5	4	1	1	83	3	4	8	15	9	17	10	4	30
October	3	3	2	2	3	1	0	0	86	5	32	11	10	6	5	2	2	27
November	5	6	3	2	1	0	0	1	81	11	47	13	5	1	1	0	2	20
December	4	6	1	1	0	0	0	1	87	12	51	13	4	1	0	0	2	17
Annual mean	3	3	1	3	3	3	1	1	82	5	30	12	9	6	11	5	2	20
No. of years	20				20				22				22				5	
	1700 I.S.T.									1700 I.S.T.								
January	6	6	5	2	0	0	1	4	76	13	49	13	3	0	0	2	12	8
February	13	4	1	1	2	5	2	10	70	4	12	36	4	3	1	5	4	7
March	11	2	0	2	3	2	4	14	60	7	12	17	3	2	1	5	45	8
April	6	3	2	2	3	2	2	16	63	3	11	19	6	1	8	9	28	15
May	3	3	1	5	19	10	3	3	53	2	3	8	9	3	6	41	10	7
June	0	0	1	9	26	14	2	1	47	1	0	2	1	1	57	18	4	17
July	1	1	0	6	17	14	1	1	59	1	0	1	1	1	57	18	4	17
August	1	1	1	5	15	14	2	3	60	0	0	1	6	3	32	21	5	11
September	1	3	1	3	9	6	2	3	72	2	1	0	4	3	32	21	9	28
October	4	4	1	3	2	1	0	1	84	2	26	12	3	5	15	5	6	26
November	3	9	3	1	1	2	1	0	80	5	38	23	3	3	3	2	5	18
December	8	9	3	0	0	0	0	6	74	2	55	31	2	1	0	0	0	9
Annual mean	5	4	2	3	8	6	2	5	65	4	17	14	4	2	22	9	13	15
No. of years	5				5				5				5				5	

Standard of time: 82½° E. meridian.

CHAPTER II

WESTERN, SOUTHERN AND EASTERN COASTS OF CEYLON, FROM COLOMBO
TO POINT PEDRO*Chart 828.*

WESTERN COAST OF CEYLON.—Aspect.—The western coast of Ceylon is low and is almost entirely covered with coconut trees. Abreast Colombo (*Lat. 6° 56' N., Long. 79° 51' E.*), the foot-hills of a mountainous district begin about 20 miles inland. Adam's peak, 7,353 feet (2,241^m2) high, situated about 40 miles east-south-eastward of Colombo and the highest land visible from off the western coast, is an excellent landmark during the North-east monsoon, but is seldom seen during the remainder of the year. Pidurutalagala (Pedrotalagala), the culminating peak of Ceylon, is not visible from off the coast.

Chart 813.

South-westward of Adam's peak there is much elevated country. Of the higher western foothills, only two are likely to be distinguished from seaward, namely Hiniduma kanda (Haycock) and Morawaka kanda. Hiniduma kanda, 2,160 feet (658^m4) high, is situated about 19 miles north-north-eastward of Point de Galle, the south-western extremity of Ceylon, and from all directions appears as a large, round-topped mountain occupying a prominent position in the foreground of the peaks; Morawaka kanda, 2,373 feet (723^m3) high, situated about 13 miles east-south-eastward of Hiniduma kanda, has three remarkable summits lying in a northerly and southerly direction, with a very steep fall. Both mountains are prominent from seaward, between a position off Barbelyn lighthouse, about 30 miles south-south-eastward of Colombo, and a position a little eastward of Point de Galle, about 40 miles farther south-eastward, and one of them is often visible when the other is covered by mist.

Depths.—Danger.—The edge of the 100-fathom (182^m9) contour line westward of Colombo is steep-to, and is a valuable guide when approaching the land in thick weather or at night.

An unexamined coral bank of unknown extent with a known depth of 7½ fathoms (14^m2) over it, lies about 17½ miles north-westward of Colombo lighthouse.

Chart 828.

Outlying bank.—In 1924, a bank marked by discoloured water, and over which a sounding of 34 fathoms (62^m2) was obtained, was reported to lie about 90 miles west-south-westward of Point de Galle.

Charts 813, 2898, 70.

Chart 828.

COLOMBO AND APPROACHES. — Aspect. — Lights. — In the vicinity of Colombo the land is low and will therefore not be seen from any great distance, but in exceptionally clear weather, the
5 Ceylon mountains and Adam's peak may be visible from a great distance.

Charts 914, 3686.

On closing the land, the buildings in that part of the town lying at the southern end of the harbour and known as the Fort, will first be
10 seen at a distance of about 12 miles. There are several prominent high buildings in the Fort, on the western side of which is the black and white tower of Colombo lighthouse (*Lat. 6° 56' N., Long. 79° 50' E.*).

On a nearer approach the following landmarks may be identified:—
St. James' church with twin towers and St. Lucia's cathedral with
15 a dome, both situated near the northern end of the town about $1\frac{1}{2}$ miles north-eastward of Colombo lighthouse; All Saints' church with a tall spire, situated about one mile eastward of the lighthouse; the new town hall with a white dome, about $1\frac{3}{4}$ miles south-eastward of the lighthouse; and the Galle Face hotel, a large red building on the
20 coast about 9 cables southward of the lighthouse. About $5\frac{1}{2}$ miles southward of this hotel is Mount Lavinia hotel (page 101), and about three-quarters of a mile north-eastward of the latter is a conspicuous banyan tree.

Colombo light is exhibited at an elevation of 85 feet (25^m9) from
25 a circular stone tower, painted in black and white chequers, 49 feet (14^m9) in height, situated on the seaward side of the Fort.

A light for the use of aircraft is exhibited, at an elevation of 305 feet (93^m0), from each of two steel framework radio masts, 270 feet (82^m3) in height, situated about $2\frac{1}{2}$ miles east-south-eastward of Colombo
30 lighthouse.

Current.—Off Colombo the current is variable and its rate is seldom more than half a knot, though in the vicinity of shoal water such as Ona gala, *see* below, it usually sets northward at a rate of $1\frac{1}{2}$ knots during the North-east monsoon.

35 **Dangers in approach.—Buoyage.**—Ona gala is a narrow ridge of dark sand and rock, the southern end of which lies about $3\frac{1}{4}$ miles northward of Colombo lighthouse. The least depth over the ridge is $3\frac{1}{2}$ fathoms (6^m4) over a head named Galwala near its northern end. There are several other heads with depths of less than 5 fathoms (9^m1)
40 over them, having depths of from 6 to 7 fathoms (11^m0 to 12^m8) between them.

Ona gala can light-buoy, painted red and exhibiting a *white flashing* light *every five seconds*, is moored about $2\frac{3}{4}$ cables south-south-westward of the southern end of Ona gala.

45 Kelani gala, a ridge similar in shape to Ona gala, with a least depth of 9 fathoms (16^m5) over it, lies with its southern end about $1\frac{1}{2}$ miles west-north-westward of Colombo lighthouse.

Pala gala, also known as Tartar rock, is a pinnacle rock with a depth of 19 feet (5^m8) over it, lying about 5 cables north-westward of Colombo
50 lighthouse; it is steep-to and the sea never breaks over it.

A red conical buoy, surmounted by a cone, is moored about $1\frac{1}{4}$ cables westward of the rock.

Galua, also known as Drunken Sailor rock, is a shoal with two rocky heads. The outer head, on which there is a depth of 4 feet

Charts 3700, 686, 813, 828, 2898, 70.

Charts 914, 3686.

(1^m2), is situated about 4½ cables south-westward of Colombo lighthouse; the inner head, about half a cable farther eastward, has a depth of 10 feet (3^m0) over it. The sea breaks over these heads during the South-west monsoon.

Chart 3686.

A red conical buoy is moored about 2½ cables westward of the outer head.

Directions.—When making Colombo from westward it is better to be southward than northward of the port as there are no conspicuous objects northward, while southward there is Mount Lavinia hotel.

Approaching from westward, vessels should steer to make Colombo lighthouse bearing about 090° until the position is ascertained when a course clear of danger may be shaped for the harbour. Coming from northward or southward, vessels should keep outside the 20-fathom (36^m6) contour line until the lighthouse bears 090°, and then proceed as above.

Port limits.—The limits of the Port of Colombo are bounded as follows:—On the south, by a line drawn due west for a distance of 3 miles from a position on the beach about one mile south-south-eastward of Colombo lighthouse (*Lat. 6° 56' N., Long. 79° 50' E.*); on the north, by a line of the same length drawn in a 263° direction from a position on the beach about 1½ miles north-north-eastward of Mutwal point, situated about 2 miles north-north-eastward of Colombo lighthouse; on the west, by a line joining the western ends of the north and south limits; and on the east, by the shore between the north and south limits.

Chart 914.

Breakwaters.—**Lights.**—The harbour is artificially formed by three breakwaters which enclose an area between the northern side of the Fort, about 3 cables north-north-eastward of Colombo lighthouse, and Mutwal point, about 1½ miles farther north-north-eastward. The southern end of the harbour is connected with Colombo lake by a canal with locks which has a depth of 7½ feet (2^m3). The canal is being dredged to a depth of 10 feet (3^m0).

South-west breakwater, built of concrete blocks, extends about 8½ cables northward from a position about 4 cables north-north-eastward of Galbokka point, situated about 2 cables north-westward of Colombo lighthouse.

From a position about 2½ cables southward of the outer end of South-west breakwater, an arm extends about one cable north-north-eastward and terminates in the pilot station; a spur projects a short distance south-south-eastward from the head of the arm and forms a landing jetty. In 1952, work was in progress on the eastern side of South-west breakwater, increasing its width between the root and the arm to about 400 feet (121^m9).

A light is exhibited, at an elevation of 56 feet (17^m1), from a concrete tower, 61 feet (18^m6) in height, situated on the head of South-west breakwater.

A light is exhibited, at an elevation of 32 feet (9^m8), from an iron column on the head of the pilot station landing jetty.

A light is exhibited, at an elevation of 50 feet (15^m2), from a position about a quarter of a cable north-north-westward of the head of the pilot station landing jetty.

Charts 3686, 3700, 68b, 813, 828, 2898, 70.

Chart 914.

Island breakwater, also built of concrete blocks, extends about $4\frac{1}{2}$ cables north-eastward from a position about $1\frac{1}{2}$ cables east-south-eastward of the head of South-west breakwater.

- 5 Lights are exhibited, at an elevation of 42 feet (12^m8), from two stone-coloured cylindrical towers, 40 and 37 feet (12^m2 and 11^m3), respectively, in height, situated one on the southern, and one on the northern, end of Island breakwater.

North-east breakwater, built of broken rubble, extends about 10 2 cables westward from Mutwal point.

A light is exhibited, at an elevation of 44 feet (13^m4), from a concrete tower, 33 feet (10^m1) in height, situated on the outer end of North-east breakwater.

- The Fishery harbour mole extends about $1\frac{1}{2}$ cables northward from 15 a position on the coast about $1\frac{1}{2}$ cables east-north-eastward of the root of North-east breakwater, and affords shelter to fishing craft in a small and shallow harbour.

A light is exhibited from an iron column on the head of the Fishery harbour mole.

- 20 **Outer roadstead.—Anchorage.**—Ballast, ashes or other refuse must not be thrown overboard in depths of less than 12 fathoms (21^m9).

Vessels awaiting berths, or in quarantine, or not wishing to enter harbour for any other reason, should anchor about $1\frac{1}{2}$ miles north- 25 north-west of the northern entrance to the harbour, in an area the centre of which is in lat. $6^{\circ} 59' N.$, long. $79^{\circ} 50.5' E.$ (approx.). Vessels are requested not to anchor within one mile of the harbour entrances.

- Pilots.**—The pilot station (*Lat. $6^{\circ} 57' N.$, Long. $79^{\circ} 51' E.$*) is situated on the spur of the South-west breakwater. Pilots are avail- 30 able throughout the 24 hours; the port is open day and night.

Pilotage is compulsory for all vessels excepting such as are exempted by authority of the Master Attendant.

- A vessel intending to enter the harbour should make one of the signals prescribed by the International Code and indicate her name 35 and draught as soon as she arrives within visual signalling distance of the port.

- To facilitate embarkation of the pilot, a vessel should, unless previously intercepted by the pilot launch, pick him up about one mile north-north-westward of the South-west breakwater lighthouse, 40 as indicated on chart 3686, approaching the position, when possible, on a south-easterly course.

A motor launch, exhibiting the customary signals, will board vessels in this position.

- The following provisions should be made to assist the pilot 45 boarding:—

A pilot ladder should be shipped on the lee side.

Two manropes of at least 3-inch rope, with the lower ends free, to be hung from the vessel's rail.

- By night, a bright light to be shown midway between rail and 50 water to indicate the position of the ladder and the manropes.

In vessels of high freeboard fitted with gangway doors, the lee gangway door to be opened and the ladder and manropes hung from there.

At night the intentions of the pilot will be signalled. See page 97.

Charts 3686, 3700, 68b, 813, 828, 2898, 70.

Chart 914.

In the event of the weather conditions being such as to preclude the vessel being boarded by the pilot outside the harbour, she may, at the discretion of the Master Attendant, be given the option of proceeding into harbour and picking up the pilot inside, the vessel 5 being instructed by signal whether to run in or stand off.

Vessels waiting to enter should remain under weigh as convenient, well clear of both entrances.

A vessel intending to leave harbour should make one of the signals for a pilot (*see* page 98) half an hour before she is ready to sail. 10

In normal circumstances the pilot will leave an outgoing vessel as she passes the pilot station.

If at any time assistance is required from the Master Attendant's department the signal should be made for a pilot. *See* page 98.

Entrances.—Depths.—The western entrance between South-west 15 and Island breakwaters, is about $1\frac{1}{2}$ cables wide and carries a least depth of 38 feet (11^m6). It is available for vessels of 34 feet (10^m4) draught. There is a disturbed swell across this entrance during the South-west monsoon.

The northern entrance between Island and North-east breakwater, is 20 just over one cable wide and carries a least depth of 33 feet (10^m1). It is available for vessels of 29 feet (8^m8) draught.

Vessels may enter and leave the harbour by whichever entrance is the more convenient, subject to the northern entrance being restricted to vessels of 29 feet (8^m8) draught and under. At night, vessels pass 25 midway between the *red* and *green* lights on the breakwater heads.

The central portion of the harbour is swept to a depth of 36 feet (11^m0) and the greater part of the remainder has depths of over 30 feet (9^m1) as shown on chart 914. Vessels are not permitted to navigate the harbour or to lie at moorings with a depth of less than 2 feet (0^m6) 30 under their bottoms, excepting by special sanction of the Master Attendant.

Piers and jetties.—Lights.—Mutwal quay, a jetty capable of accommodating two large cargo vessels, is situated on the southern side of North-east breakwater. 35

Another jetty, extending southward from the eastern side of the harbour, about $1\frac{1}{2}$ cables southward of Mutwal quay, was nearing completion in 1952. It will be known as North pier and will be fitted with oil pipe-lines to provide a berth for large tankers.

Guide pier (*Lat.* 6° 57' N., *Long.* 79° 51' E.), extending about 800 feet 40 (243^m8) westward from the northern side of the entrance to the dry dock, is situated on the eastern side of the harbour about $2\frac{1}{2}$ cables southward of the root of North-east breakwater; the tall red-brick chimney of the dock pumping station, situated near the root of Guide pier, is conspicuous. The limit of draught permitted at the two 45 berths alongside the southern side of Guide pier is 30 feet (9^m1). These are the berths for discharging dangerous oils, but vessels berthed alongside have to be moved when ships are being docked or undocked.

Oil Discharge jetty, on the northern side of Guide pier (*Lat.* 6° 57' N., *Long.* 79° 51' E.), accommodates vessels of 27 feet (8^m2) draught 50 up to 450 feet (137^m2) in length during the South-west monsoon, and up to 500 feet (152^m4) in length during the North-east monsoon. It is the berth for vessels discharging oil cargoes and bunkering. During the South-west monsoon vessels lie alongside with an anchor

Chart 914.

ahead and secured by bow and quarter hawsers to the buoys. During the North-east monsoon vessels lie heading to the northward with stern secured to the jetty and bows to the buoy, port anchor being
5 down.

Two lights, disposed vertically, are occasionally exhibited, at elevations of 25 and 19 feet (7^m6 and 5^m8), respectively, from an iron column on the head of Guide pier.

Southward of the dock entrance is a range of 18 wooden coaling
10 jetties for lighters, with depths of about 15 feet (4^m6) alongside them. Farther southward are several other jetties including the Block jetty, on which is a flagstaff, and Patent slip jetty, for the patent slip. At the southern end of the harbour is the Passenger jetty, a double-decked pier with depths of 6 feet (1^m8) alongside; it is the official
15 town landing place, under the Customs authorities.

A light is exhibited, at an elevation of 17 feet (5^m2) from the head of the Patent Slip jetty.

A light is exhibited from each corner of the head of Passenger jetty (Lat. 6° 56' N., Long. 79° 51' E.).

20 **Mooring berths.—Buoyage.—Lights.**—A conical buoy is situated about one cable southward of the north-eastern end of Island breakwater.

During the South-west monsoon there are 36 mooring berths available for vessels of varying size up to 800 feet (243^m8) in length, and
25 34 feet (10^m4) draught. The berths are numbered as shown on the berthing plan on chart 914. Berths Nos. 1 to 5 and 7 to 21 are in the southern part of the harbour, and berths Nos. N.1 to N.5 are in the northern part.

Vessels secure head and stern between the buoys, heading west-
30 ward, with their port anchors down excepting in berths Nos. 1 and 7; at these berths the starboard anchor is let go, and, if the ship is making a long stay, the cable is shackled to the buoy. Berth No. 12 S.W., which is for the longest vessels, has no head buoy and vessels lie to both anchors.

35 If the harbour is congested some of the intervening half-berths between the berths in each line are used, vessels lying with both anchors down and their sterns secured to the stern buoys of the two neighbouring berths. This increases the berthing capacity of the harbour by 10 berths.

40 Between the middle tier of berths and the two outer tiers are the Western and Eastern channels, through which the berths are approached.

Men-of-war are berthed, when berthing conditions admit, in the western tier.

45 During the North-east monsoon there are 40 mooring berths available for vessels of varying size up to 800 feet (243^m8) in length and 34 feet (10^m4) draught. The berths are numbered as shown on the berthing plan on chart 914.

Vessels secure head and stern between the buoys, heading north-
50 ward, with their starboard anchors down in the western tier, or their port anchors down in the remaining tiers.

Vessels berthed in the eastern tier are supplied with extra stern springs by the Master Attendant, for the tending of which the vessel is responsible.

Charts 3686, 3700, 68b, 813, 828, 2898, 70.

Chart 914.

Berth No. 14 has no head buoy and vessels lie to both anchors.

Vessels can approach their berths between any of the tiers.

Men-of-war are berthed, when berthing conditions admit, in the western tier. 5

There are several berths for small vessels along the southern and eastern sides of the harbour. Vessels secure their sterns to the buoys (marked S.1 to S.3 on chart 914) and lie to either one or two anchors, heading according to the monsoon.

Native craft are berthed on the southern side of the harbour inside 10 the berths for small vessels; they lie to their own ground tackle.

A *red* fixed light is exhibited from certain of the mooring buoys near the harbour entrances when these berths are unoccupied.

Two pairs of leading lights have been established on the southern side of the harbour. The front light of the western pair is exhibited 15 at an elevation of 42 feet (12^m8) from a white mast situated close eastward of the root of the Passenger jetty (*Lat. 6° 56' N., Long. 79° 51' E.*); the rear light is exhibited, at an elevation of 50 feet (15^m2) from a white mast about 1½ cables southward of the front light. These lights in line, bearing 188°, lead between the second and third lines 20 of mooring buoys.

Of the eastern pair, the front light is exhibited, at an elevation of 58 feet (17^m7) from a black beacon, situated about one cable eastward of the head of the Patent Slip jetty; the rear light is exhibited, at an elevation of 73 feet (22^m3), from a clock tower about 1½ cables south- 25 ward of the front light. These lights in line, bearing 190°, lead between the fourth and fifth lines of mooring buoys.

Caution.—All vessels in Colombo harbour, after they have been moored to the satisfaction of the Master Attendant, are responsible for tending their own mooring hawsers. 30

Harbour signals.—The following special signals are in use in Colombo harbour :—

<i>By day.</i>	<i>By night.</i>	<i>Signification.</i>
Red ball . . .	<i>Red fixed light</i>	Shown at the pilot station flagstaff (<i>see page 94</i>) when 35 vessels are required to run out extra mooring ropes to the buoys and prepare for letting go a second anchor. 40
Signal KXR of the International Code of Signals		Displayed at the pilot station flagstaff when weather conditions are such as to preclude vessels being boarded by the pilot out- 45 side the harbour.
	Alternate <i>red</i> and <i>white</i> flashes	Shown from pilot station indicates that a pilot is coming off now.
	A series of <i>red</i> flashes	Shown from the pilot station 50 indicates that the pilot is engaged and will come off when disengaged.

Charts 3686, 3700, 68b, 813, 828, 2898, 70.

Chart 914.

	<i>By day.</i>	<i>By night.</i>	<i>Signification.</i>
5		A series of long <i>white</i> flashes	Shown from the pilot station signifies :—Pilot cannot come off. Anchor or remain off the port till daylight.
10	Signal NQ of the International Code of Signals	Three <i>red</i> lights vertically disposed 6 feet (1 ^m 8) apart, hoisted where best seen	Shown by a vessel indicates that she is on fire. <i>Note</i> : Attention may be called to this signal by a continuous sounding with any fog-signalling apparatus.
15	International Code Signal for a pilot	Two <i>red</i> lights vertically disposed	Shown by vessels in harbour indicates that a pilot is wanted.
20	Signal ST of the International Code of Signals	<i>White</i> , <i>red</i> , and <i>white</i> lights vertically disposed	Shown by vessels indicates that the police are wanted.
	Flag W of the International Code of Signals	<i>Red</i> , <i>white</i> and <i>red</i> lights vertically disposed	Shown by vessels indicates that the port surgeon is wanted.
25	Flag N of the International Code of Signals	Two <i>white</i> lights, vertically disposed	Vessel ready to work.
	Signal QN of the International Code of Signals	Three <i>white</i> lights vertically disposed	Shown by vessels indicate that :— Empty lighters are wanted. Cargo is wanted.
30	Signal CWF of the International Code of Signals		
	Signal FQ of the International Code of Signals		Hiring launch wanted.
35	Flag Q of the International Code of Signals	Two <i>white</i> lights vertically disposed	Shown by vessels indicates that the vessel exhibiting it requests pratique.
40	Signal QQ of the International Code of Signals		Displayed by vessels indicates that the vessel displaying it is "suspect" (<i>vide</i> International quarantine signals).
45	Signal QL of the International Code of Signals		Displayed by vessels indicates that the vessel displaying it is "infected."
50		<i>Red</i> and <i>white</i> lights, vertically disposed	Exhibited by vessels indicates that the vessel exhibiting it has not yet received pratique.
	House flag under ensign at stern	<i>White</i> light under stern light	Shown by vessels to whom "Restricted pratique" has been granted.

Charts 3686, 3700, 68b, 813, 828, 2898, 70.

Chart 914.

<i>By day.</i>	<i>By night.</i>	<i>Signification.</i>
One long blast on , siren followed by four short blasts.		Signal for tug.
	<i>Note :</i> This sound signal is only to be used 5 in case of emergency.	

In the event of a vessel observing that a person has fallen overboard from any ship or other craft in the harbour, the vessel should, after having taken action such as throwing a lifebuoy or hailing the nearest boat, make the following signals:— 10

<i>By day.</i>	<i>By night.</i>
Flag "O" of the International Code of Signals, hauled up and down to attract attention; also short blasts on the siren or whistle.	The Morse letter "O," flashed in the direction of the pilot station; also short blasts on the siren or whistle. 15

Note.—The above signals will be observed by either the pilot station, the Harbour police, or the Port fire brigade, and a motor-boat will then be despatched to the scene.

Day watch only is kept at the signal station. 20

Day and night watch is kept at the pilot station.

When a large red flag is displayed on a floating crane engaged on new construction work, all vessels passing or in the vicinity are to proceed at such a speed that they cause no wash or any kind of disturbance affecting the crane. 25

Quarantine.—The appropriate quarantine signal, *see* page 98 is to be displayed by all vessels arriving in the harbour and no person except the pilot is allowed to board or to leave the vessel until pratique is given.

Vessels having, or having had within ten days previous to arrival 30 any infectious disease, are placed in quarantine for a period decided by the Chairman of the Board of Immigration and Quarantine. In such a case, the vessel may have to anchor in the roadstead or other place as directed by the Master Attendant.

Vessels in quarantine must display the necessary signals, *see* page 98. 35

Vessels discharging dangerous oil.—To avoid risk of fire or accident, vessels discharging dangerous petroleum are surrounded, at a distance of not less than 100 feet (30^m5), by a rope boom floated on red wooden buoys and marked by the following signals:—

(a) By day, a red flag over a green flag. 40

(b) By night, four lights, *red* and *green* alternately, vertically disposed.

Town.—The town of Colombo was originally founded as a European settlement by the Portuguese, in 1518, who erected a fort. Colombo, together with the maritime provinces of Ceylon, fell into the hands 45 of the Dutch in 1656, and was surrendered to the British in 1796.

What may be called the old town of Colombo consists of the Fort and the Pettah or native town; this forms only a small part of the present city of Colombo which extends both northward and southward of the old town. 50

The Fort (*Lat.* 6° 56' N., *Long.* 79° 51' E.), so called on account of the old Portuguese and Dutch fortifications which entirely encircled

Chart 914.

it in former days, but are now removed, is laid out as a modern European town, in which are the Governor's residence (Queen's house), Government offices and the clock tower which stands on the highest
5 part.

In the Pettah, separated from and situated eastward of the Fort, are the Town hall and municipal offices; in the district known as Hulftsdorp are the Law courts and All Saints' church with a tall conspicuous spire. About $3\frac{1}{2}$ cables northward of the latter is Wolfendahl Presbyterian church with a white conical dome, which is prominent
10 from most parts of the harbour; in this church are the tombs of several of the Dutch governors.

Mutwal suburb stretches from the northern part of the native town almost to the southern bank of Kelani ganga, and contains Christ-
15 church cathedral with a square tower, situated about $1\frac{1}{4}$ cables southward of the dry dock, and St. Lucia's cathedral (*see* page 92).

Southward of the Fort is Galle Face, a fine esplanade, and Slave island, the military headquarters (chart 3686).

The population, in 1951, was about 362,000.

20 **Trade.**—The principal exports are tea, coffee, cinnamon, areca nuts, coconut oil, coir, plumbago, copra and coconuts; the chief imports are coal, machinery, hardware and rice.

In 1951, 2,724 vessels of a total tonnage of about 12,000,000 entered the port.

25 **Port facilities.**—A large stock of coal and of fuel oil is maintained.

Coal is supplied by manual labour from lighters; in 1951, the average rate of supply was about 500 tons per day but mechanical plant was then in course of construction.

Fuel oil can be supplied to vessels alongside at rates of from 150
30 to 100 tons per hour. Vessels not desiring to go alongside can be supplied from lighters.

Fresh provisions are plentiful. Fresh water can be supplied by water boats.

There is a dry dock and a patent slip; for dimensions of the former,
35 *see* Appendix I, page 487.

All repairs to vessels can be undertaken. There are several cranes, the largest of which has a lifting capacity of 35 tons. European or native divers can be obtained and fire-fighting and salvage appliances are available.

40 There are four Port Commission tugs, but usually only two are on duty. In 1951, tugs were not available for salvage work at sea; two new tugs were under construction. For the emergency signal for a tug, *see* page 99.

Seamen are admitted to a general hospital at Maradana, situated
45 about 2 miles south-eastward of Colombo lighthouse.

The offices of the Port Commission and of the Master Attendant are situated in the Custom house, about $1\frac{1}{4}$ cables westward of the root of the Passenger jetty. There is a shipping office and a sailors' home in the town.

50 **Life-saving.**—3 Power lifeboats are maintained and 3 life-saving tugs are normally available.

Communications.—**Radio station.**—**Radiobeacon.**—There is regular sea communication between Colombo and all parts of the world.

Charts 3686, 3700, 686, 813, 828, 2898, 70.

Chart 914.

There is railway communication with Kandy and with the principal towns on the coast of Ceylon.

There is a radio station at Welikada, about $2\frac{1}{2}$ miles south-eastward of the harbour, *see* page 38. A radiobeacon transmits from the radio station. 5

Climatic table.—*See* page 70.

Charts 3686, 3700.

COLOMBO TO POINT DE GALLE.—**Galbokka point to Mount Lavinia.**—**Aspect.**—Galbokka point (*Lat.* $6^{\circ} 56' N.$, *Long.* $79^{\circ} 51' E.$) is a black, rocky knoll, 14 feet (4^m3) high, connected with the coast on the western side of the Fort by a short sandy isthmus; several detached rocks lie close off the point. Southward of this point, the coast consists of a sandy beach with trees and coconut palms growing close to the water's edge. 15

Prominent objects situated within the coast between Galbokka point and the Galle Face hotel have been described on page 92. At night, Galle Face esplanade is lit by a row of brilliant *white* lights along the coast. Farther southward are the bungalows of the various suburbs stretching along the Kollupitiya (Colpetty) road; the louvered 20 exteriors of the railway stations at Kollupitiya, Bambalapitiya, Wellawatta, Dehiwala and Mount Lavinia, situated respectively about half a mile, $1\frac{3}{4}$, $2\frac{3}{4}$, $4\frac{1}{4}$ and $5\frac{1}{4}$ miles, southward of the Galle Face hotel, are painted stone colour, and in the afternoon light show up prominently on the very edge of the beach. Nawagam kanda, a 25 small flat-topped and wooded hill about 9 miles eastward of Kollupitiya station, is not easily identified.

Mount Lavinia may be identified by the hotel, a large white building standing on a rocky eminence at the edge of the sea; behind it, the land rises gradually for a short distance, forming a dark background 30 which renders it the most conspicuous object on this part of the coast, and on a clear afternoon it is visible seaward from a distance of 12 miles.

At about three-quarters of a mile northward of Mount Lavinia and about 2 cables inland, is a large banyan tree which is usually very conspicuous, its rounded top standing well above the straight even 35 line of the coconut palm tops.

The 10-fathom (18^m3) contour line runs parallel with this stretch of coast about one mile offshore. Madi gala, with a least depth of 12 fathoms (21^m9) over it, lies about $2\frac{1}{4}$ miles west-south-westward of Kollupitiya station and Ekveni gala, with a depth of 13 fathoms 40 (23^m8) over it, lies about $3\frac{1}{4}$ miles west-north-westward of Mount Lavinia hotel.

Dangers.—**Anchorage.**—**Lights.**—Between Galbokka point and Mount Lavinia, a narrow ridge of gneiss rock, awash in some places and having the appearance of a barrier reef, lies parallel with the beach 45 at a distance of about one cable from it. The average depth just outside this ridge is 4 fathoms (7^m3), with from one to 2 fathoms (1^m8 to 3^m7) between it and the beach.

At about half a mile westward of the conspicuous banyan tree there is a break in the ridge through which small vessels with local knowledge 50 can pass and obtain anchorage under the protection of the ridge. This passage cannot be used in the height of the South-west monsoon.

Leading lights have been established for the use of local fishing craft.

Charts 68b, 813, 828, 2898, 70.

Charts 3686, 3700.

The front light is exhibited, at an elevation of 30 feet (9^m1), from a white concrete beacon, 20 feet (6^m1) in height, situated on the beach about 2 cables westward of the conspicuous banyan tree; the rear light is exhibited, at an elevation of 35 feet (10^m7) from a coconut tree about 60 yards (54^m9) eastward of the front light. These lights in line with the conspicuous banyan tree, bearing 099°, lead through the passage in the ridge in a depth of 2 fathoms (3^m7).

Chart 3700.

10 **Mount Lavinia to Beruwala point.—Aspect.**—Between Mount Lavinia and Maggona point, about 21 miles south-south-eastward, the coast is very similar in appearance to that northward of Colombo and consists of a narrow sandy beach with dense groves of coconut palms immediately behind it, the tops of which rise to a uniform height of
15 about 85 feet (25^m9); the land for from 10 to 20 miles inland is densely wooded and there are numerous towns and villages. Maggona point, which is a small rocky headland about 30 feet (9^m1) high, forms the first break in the straight sandy beach and about 2 miles farther southward is Beruwala point (*Lat. 6° 28' N., Long. 79° 58' E.*).

20 Between Colombo and Point de Galle, about 60 miles south-south-eastward and thence to Matara, about 20 miles farther east-south-eastward, the railway runs practically along the sea-front for the whole distance, connecting all the coastal towns; the entrances to rivers, inlets and creeks are crossed by iron girder bridges which are
25 usually visible from seaward. Government rest-houses are established along the coast, usually close to the railway stations.

Oleboda kanda, a small flat-topped and wooded hill, 371 feet (113^m1) high, situated about 10 miles east-south-eastward of Mount Lavinia, is not easily identified. Some low hills are situated close within the
30 coast between Kálutara, about 16 miles south-south-eastward of Mount Lavinia, and Beruwala; the northernmost of these hills, which is distinctive, is Bombuwela, a small range about 2 miles long having near its southern end a prominent, flat-topped hill, 522 feet (159^m1) high. See view B on chart 3700.

35 Weragala (Weragal) kanda, about 4½ miles south-south-eastward of Kálutara and about one mile inland, is a conical hill, 351 feet (107^m0) high, which is prominent from seaward; it is isolated and wooded except at the summit which is bare and crowned by a white monument. Several other hills about 500 feet (152^m4) high are
40 situated about 5 miles within the coast between Kálutara and Beruwala point, but they are not easily identified. See view B on chart 3700.

Coast.—From a distance of about 4 miles offshore, there are no conspicuous landmarks between Mount Lavinia and Beruwala point.

45 Moratuwa, situated on the coast about 3½ miles south-south-eastward of Mount Lavinia, is a fair-sized town with a population of 32,409 in 1931; Immanuel church has a red square tower and may sometimes be distinguished in the town. Pánadure, situated on the coast about 4 miles farther south-south-eastward, had a population
50 of 12,946 in 1931. Neither of these towns has any seaborne trade owing to the surf which fringes the coast abreast them.

Pánadure ganga, a long and irregular fresh-water lagoon, is situated about 2 miles within the coast and roughly parallel with it. When full from the rains, it flows into the sea abreast the town, but its mouth

Chart 3700.

is usually barred by sand. A system of canals connects its northern end with Colombo, and its southern end with Kálu ganga.

Between Pánadure and Kálutara, about $8\frac{1}{2}$ miles farther south-south-eastward, is a featureless sandy beach on which the surf beats continuously, but close within the beach at about one mile southward of Pánadure, is a solitary round-topped banyan tree which may be seen from a distance of 10 miles.

Kálutara, an important town with a population of 14,280 in 1931, is situated on both sides of the Kálu ganga, the mouth of which is impassable except for native canoes on account of surf; the river is about 62 miles in length from its source in the southern part of the mountain district. An Assistant Government Agent resides in Kálutara.

Close eastward of Maggona point (*Lat. $6^{\circ} 30' N.$, Long. $79^{\circ} 59' E.$*) is a village of the same name and between the point and Beruwala point there is a sandy beach. On the eastern side of a rocky promontory at the northern end of Beruwala point is a small bay; Beruwala village stands about three-quarters of a mile from the Custom house, which is at the landing place.

Beruwala bay is the first place southward of Colombo which is safe for boat landing. Here landing may be effected on the western side of the bay, even during the South-west monsoon, though, owing to the shelving nature of the beach, the approach is shallow and it is generally necessary to wade.

Landing may be effected at Maggona on a fine day, but it is neither good nor safe.

There are two small piers on the eastern side of Welmaduwa island, *see* page 104, at which landing is generally possible.

Off-lying dangers.—A narrow rocky bank, with a depth of less than 6 feet (1^m8) over it, lies about half a mile from the coast and parallel to it for a distance of 2 miles southward of Mount Lavinia. A rocky patch, with a depth of $2\frac{3}{4}$ fathoms (5^m0) over it, lies about half a mile offshore westward of Moratuwa, and depths of $3\frac{1}{4}$ and $3\frac{1}{2}$ fathoms (5^m9 and 6^m4) lie within a mile southward of the rocky patch.

Gona gala is the outer of two rocks lying about one mile westward of the station at Pánadure; it is round-topped and 15 feet (4^m6) high. There are depths of $3\frac{1}{4}$ fathoms (5^m9) close outside it. Alut gala, with a depth of $3\frac{1}{4}$ fathoms (5^m9) over it, lies about half a mile south-south-westward of Gona gala. Nilkete rock consists of two heads, with depths of 2 fathoms (3^m7) over them, lying about three-quarters of a mile southward of Alut gala; there is a 5-fathom (9^m1) patch close westward of Nilkete rock. Po gala, a rock with a depth of $2\frac{3}{4}$ fathoms (5^m0) over it, lies about 3 cables southward of Nilkete rock; there is a patch, with a depth of $4\frac{1}{4}$ fathoms (7^m8) over it, about three-quarters of a mile south-eastward of Nilkete rock. Between the above-named shoals and the coast are numerous other shoal patches.

Kaluwatte gala, with a depth of 5 fathoms (9^m1) over it and steep-to, lies about 2 miles southward of Po gala. Uan gala, with a depth of 3 fathoms (5^m5) over it and steep-to, lies about 6 cables south-eastward of Kaluwatte gala.

Uheliya reef (*Lat. $6^{\circ} 35' N.$, Long. $79^{\circ} 55' E.$*), a narrow reef with depths of from 4 to 5 fathoms (7^m3 to 9^m1) over it and surrounded by

Charts 68b, 813, 828, 2898, 70.

Chart 3700.

depths of 6 and 7 fathoms (11^m0 and 12^m8), is the outer shoal of an area of shoals and uneven ground lying off the mouth of the Kálu ganga; it lies parallel with the coast at a distance of about 2½ miles from it.

Pittaniya rock, with a depth of 3 fathoms (5^m5) over it, lies about 1½ miles west-south-westward of Kálutara station. Pallaipara rock, with a depth of 1½ fathoms (2^m7) over it, lies about 1½ miles south-westward of Kálutara station, and Módara Muduwa rock, with a least depth of one fathom (1^m8) over it, lies about half a mile farther southward.

A shoal, with a depth of 3½ fathoms (6^m4) over it, and steep-to, lies about 2½ miles north-westward of Maggona point and about 1½ miles offshore; it is the outer shoal of a large area of foul ground which lies off the coast in this vicinity. Tria gala, 5 feet (1^m5) high, steep-to, and surrounded by depths of 4 and 5 fathoms (7^m3 and 9^m1), lies about one mile west-north-westward of Maggona point. A rock, which always breaks, and is easily seen, lies nearly a mile westward of the point.

Numerous dangers lie north-westward and westward of Beruwala point; of these, Prompt rock, with a depth of 4½ fathoms (8^m2) over it and steep-to, lying about 3 miles west-north-westward of the point, is the outermost. Madda gala, with a depth of 3½ fathoms (5^m9) over it and steep-to, lies about 2½ miles west-north-westward of the point. These are important dangers, they are small and the depths might be less in the swell of the South-west monsoon; soundings give no warning of approach to them.

Goda gala, with a depth of 6½ fathoms (11^m9) over it, and Nalla gala, with a depth of 1½ fathoms (2^m7) over it, lie about 1½ miles and three-quarters of a mile, respectively, north-westward of Beruwala point. Yakada gala, 8 feet (2^m4) high, is the outermost rocky islet off Beruwala point, being situated about half a mile westward of it; it is surrounded by depths of 5 fathoms (9^m1); a rock, which dries one foot (0^m3), and nearly always breaks, lies about half a cable northward of Yakada gala.

35 Anchorage.—Directions.—During the fine weather period of the North-east monsoon it is possible to anchor almost anywhere off this coast, outside and clear of the broken foul ground; the holding ground is good, over a bottom of soft green mud.

If anchoring off Kálutara, a vessel should approach the anchorage, which is in depths of 5 or 6 fathoms (9^m1 or 11^m0), about one mile off the entrance to the river, by passing between Uheliya reef and Pittaniya rock. This anchorage is for small vessels with local knowledge.

It is not advisable to anchor off Beruwala in depths of less than 6 or 7 fathoms (11^m0 or 12^m8) owing to the dangers already described, and the swell which is generally experienced.

Welmaduwa Island.—Light.—Welmaduwa island lies about half a mile south-westward of Beruwala point; the highest part, which is seaward, is a rocky cliff, with an elevation of 47 feet (14^m3); the island is covered with coconut palms. Landing is generally possible at two small piers on the eastern side of the island, *see* page 103.

Vessels navigating along the coast should give the island a berth of 4 miles.

Barbery light (*Lat.* 6° 28' N., *Long.* 79° 58' E.) is exhibited, at an

Charts 68b, 813, 828, 2898, 70.

Chart 3700.

elevation of 150 feet (45^m7), from a white circular tower, 111 feet (33^m8) in height, on the summit of Welmaduwa island. See views A and B on chart 3700.

Beruwala point to Godagala point.—Coast.—Dangers.— 5
Between Beruwala point and Udapitya point, the southern entrance point of the Bentota ganga, about 2½ miles south-south-eastward, the coast is sandy with small rocky projections. A rest house, standing amongst trees on Udapitya point, is moderately prominent; Alut-gama railway station is situated on the opposite side of the river 10 entrance.

Godagala point is a dark-coloured rocky headland, about 30 feet (9^m1) high, situated about one mile southward of Udapitya point and is not very prominent. Bentota ganga is a small stream with a shallow and rocky bar on which the sea usually breaks; it can only 15 be entered by canoes which can ascend it for a distance of about 12 miles.

There are several above-water rocks off this stretch of coast which are black and bare of vegetation. The most prominent of these are Paraiduwa, 15 feet (4^m6) high, about half a mile south-south-eastward 20 of Barbaryn lighthouse; Palli gala, 20 feet (6^m1) high, about 6 cables farther southward; and Handran gala, which is the largest, 8 feet (2^m4) high and surmounted by a boulder, situated about half a mile west-north-westward of Godagala point. Several small rocks with foul ground generally, lie between Handran gala and the coast and 25 this passage is unsafe except for native canoes.

Godagala point to Ahungalla point.—Aspect.—Between Godagala point and Ahungalla point (*Lat.* 6° 19' N., *Long.* 80° 02' E.), about 6½ miles south-south-eastward, the coast consists of a brown sandy beach interrupted by several small rocky headlands and backed, 30 nearly to the water's edge, by thickly planted coconut trees.

Galboda kanda, a flat-topped hill, 154 feet (46^m9) high, with a temple and a white monument on its summit, is situated about 2 miles south-south-eastward of Godagala point and about half a mile inland; it is prominent from seaward and in clear weather, is visible from 35 a distance of about 10 miles.

Southward of Galboda kanda, the foothills of the mountain district approach the coast, but the only summits which are easily distinguished are Duwemodera hill and Pelagas kanda. Duwemodera hill, about 220 feet (67^m1) high, isolated and with a small ridge extending 40 eastward from it, stands about 2½ miles south-south-eastward of Galboda kanda and is moderately prominent. Pelagas kanda, about 300 feet (91^m4) high, situated about 1½ miles east-south-eastward of Duwemodera hill, is flat-topped and is rendered distinctive by a single tree on its summit. See view A on chart 3700. 45

Coast.—Dangers.—From Godagala point, the coast trends south-south-eastward for about 1½ miles to Yakgahagala point, a small headland of bare sloping rock, 35 feet (10^m7) high, which is plainly visible from a distance of three or four miles. Kaikawalagala (Kayikawalagala) point about 1½ miles south-south-eastward of Yakgahagala 50 point, is a low, rocky headland and Sabungala (Babungala) point, which is about 25 feet (7^m6) high and reddish-coloured, lies about half a mile farther southward.

From Sabungala point, the coast trends south-south-eastward for

Charts 68b, 813, 828, 2898, 70.

Chart 3700.

about three-quarters of a mile to Arangala point, rocky and about 40 feet (12^m2) high, and thence about 2½ miles farther south-south-eastward to Ahungalla point (*Lat. 6° 19' N., Long. 80° 02' E.*), a cliffy 5 eminence, 140 feet (42^m7) high and covered with coconut palms. Kola islet, with a few coconut trees on it, forms the southern part of Ahungalla point to which it is connected by a narrow drying strip of sand.

A small hill, 110 feet (33^m5) high and crowned by a temple and 10 monument, is situated about half a mile eastward of Arangala point, but, being surrounded by trees, it is not visible from all directions.

Duwemodera lake is a small lagoon immediately behind the beach, about one mile south-south-eastward of Arangala point; Kosgoda village, which is long and straggling, lies on the eastern side of the 15 lake, while Kosgoda railway station is situated about 1¼ miles south-south-eastward of the lake.

Dangers.—Deba gala, a boulder with depths of 9 feet (2^m7) over it, lies about half a mile west-south-westward of Godagala point; Maharatarata, a group of large boulders with three heads, over which 20 the depths are 3 feet (0^m9), lies about a quarter of a mile southward of Deba gala; and Nabutara, a rocky ledge, the shoalest part of which is awash, lies about a quarter of a mile south-eastward of Maharatarata.

Dodampara rocks are two small rocks, 3 feet (0^m9) high, situated 25 about 3 cables westward of Kaikawalagala point; Idamelle, a reef with depths of from 5 to 6 feet (1^m5 to 1^m8) over it, lies about 2 cables north-westward of Dodampara rocks; and Walapara, a flat-topped rock over which the depth is 4 feet (1^m2), lies about 2½ cables south-eastward of Dodampara rocks. All these rocks are surrounded by 30 depths of from 3 to 6 fathoms (5^m5 to 11^m0).

A ridge, over which there are depths of from 3½ to 5 fathoms (6^m4 to 9^m1), lies parallel with the coast between Sabungala point and Duwemodera lake, and about 1½ miles offshore.

A small rock, awash and steep-to, lies about 1½ miles north-westward 35 of Ahungalla point. Southward of this rock awash, is a ridge with a least depth of 3½ fathoms (6^m4) over it which extends as far as Kola islet, lying parallel with the coast and about one mile offshore.

A 6-fathom (11^m0) patch, which is steep-to, lies about 2¼ miles westward of Ahungalla point.

40 **Ahungalla point to Madame lake.—Coast.**—A low, rocky promontory, covered with coconut trees, is situated about 1½ miles south-south-eastward of Ahungalla point, and about 1¼ miles beyond is Balapitiya point, a low, flat, double point, planted with coconut trees; a large boulder, 35 feet (10^m7) high, is situated on the coast 45 between the unnamed promontory and Balapitiya point.

Madu ganga, in reality a lake, lies close inland between Ahungalla and Balapitiya points, and is connected with Randambe, a smaller lake southward of it. The entrance common to these two lakes is just northward of Balapitiya point, and only admits canoes.

50 **Ambalangoda** (*Lat. 6° 14' N., Long. 80° 03' E.*), a town with 3,745 inhabitants, in 1931, is situated about 2½ miles south-south-eastward of Balapitiya point, and between are a succession of sandy beaches with small, low, rocky points. The line of coconut palms, close to the water's edge, obstructs any view of the land behind.

Charts 68b, 813, 828, 2898, 70.

Chart 3700.

Genawana, a rocky islet with a square top, slightly vegetated, lies about 3 cables offshore at Ambalangoda.

Ambalangoda rest-house, standing at an elevation of 20 feet (6^m1), may be seen through the trees about half a mile southward of Ambalangoda. 5

Ambalangoda village, which is large and joins Balapitiya village northward, is on both sides of the rest-house, and there is a considerable fishing community.

In fine weather, landing may be effected on the northern side of 10 Genawana islet, but between it and the coast is foul ground, on which the sea breaks in ordinary weather.

Landing may also be effected, during the North-east monsoon, on a sandy beach between two points of rock immediately southward of Ambalangoda rest-house, and, although the sea appears to break 15 across it, a small boat may enter with ordinary care.

Dangers.—Foul ground extends about 4 cables off the entrance to Madu ganga. Kupata, a small group of rocks awash, with depths of from 5½ to 7 fathoms (10^m1 to 12^m8) around, lies about 1½ miles northward of Balapitiya point; Wetiepara, with a depth of 1½ fathoms 20 (3^m2) over it and 5 fathoms (9^m1) around it, lies about a quarter of a mile southward of Kupata; Neligalpara, with a depth of 1½ fathoms (2^m3) over it and steep-to, lies about three-quarters of a mile north-westward of Balapitiya point; Mainbapara, a small double-headed rock, 3 feet (0^m9) high, and steep-to on its seaward side, lies on the 25 outer edge of the foul ground which extends from the coast in this vicinity, about a quarter of a mile north-westward of Balapitiya point.

For a distance of about 1½ miles southward of Balapitiya point there are depths of from 3½ to 4½ fathoms (5^m9 to 8^m2) at about one mile 30 offshore.

A 5-fathom (9^m1) patch, surrounded by depths of from 6½ to 8½ fathoms (11^m9 to 15^m5), lies nearly one mile west-north-westward of Genawana islet.

Two small rocks, the southern named Hirae, and having depths 35 of 3½ and 3½ fathoms (5^m9 and 6^m4) over them are situated about 1½ and 5 cables, respectively, southward of Genawana islet; they have depths of from 5 to 7 fathoms (9^m1 to 12^m8) around, and care is necessary to avoid them when approaching the landing place.

Patiagala point to Dodanduwa point.—Coast.—Dangers.— 40 The entrance to Madampe lake is usually barred by sand except in the rainy season. Patiagala point (*Lat.* 6° 13' N., *Long.* 80° 03' E.), the southern entrance point, situated about a quarter of a mile southward of Ambalangoda rest-house, is 15 feet (4^m6) high. Between Patiagala point and Akurala (Akorale) point, about 2 miles south- 45 south-eastward, the coast is bordered by a sandy beach, but at about half a mile from Akurala point the usual line of coconut trees is broken by a considerable gap which is clearly visible from seaward; Delmar or Galgoda, a hill, 120 feet (36^m6) high, with a solitary tree on its summit, situated about 1½ miles from the coast, is visible through 50 this gap.

Attupella, with a depth of 2 fathoms (3^m7) over it, lies close offshore just southward of Patiagala point; a small rock 3 feet (0^m9) high, lies about 2 cables southward of Attupella, and rocky, foul ground extends

Chart 3700.

for about three-quarters of a mile offshore between Patiagala and Akurala points.

Passi rock, a dangerous dark-coloured rock, consisting of five heads, lies about one mile westward of Akurala point, and is closely surrounded by depths of from 7 to 9 fathoms (12^m8 to 16^m5). On one of the heads, about 2 feet (0^m6) high, the sea always breaks, even in the finest weather; the southernmost head is awash, and the rest appear to have depths of less than one fathom (1^m8) over them.

- 10 Passi rock should be given a good berth, as the bottom is irregular for about 3½ cables westward of it; although a deep channel exists between it and the coast, it should not be attempted, as shoals extend about 4 cables off Akurala point, and the bottom is foul.

A 10-fathom (18^m3) patch and a 20-fathom (36^m6) patch, both reported in 1944, lie about 11½ miles south-westward, and about 11 miles west-south-westward, respectively, of Akurala point.

Telwatta point lies about 3 miles south-south-eastward of Akurala point; it consists of several large rocks, and has the ruins of a large temple on it.

- 20 Foul ground extends about one mile off the coast between Akurala point and Telwatta point; the outer rock, situated about 1½ miles north-westward of the latter point, has a depth of 2½ fathoms (4^m1) over it and depths of from 4½ to 5 fathoms (8^m7 to 9^m1) around.

Debaha rock is a black, doubled-headed rock, about 4 feet (1^m2) high, situated about 3½ cables westward of Telwatta point.

Hikkaduwa point, about 1½ miles farther south-south-eastward, is low, flat, and covered with coconut trees amongst which a rest-house on the point is almost hidden; the village of Hikkaduwa lies along the road northward of the point.

- 30 Waal islet, 30 feet (9^m1) high, is a large group of rocks with flat tops, situated on the outer edge of the foul ground extending about 4 cables westward from Hikkaduwa point; it is moderately prominent from seaward.

Landing may be effected in fine weather, in a small bay northward of Waal islet, passing through, or over, the coral reef which crosses its entrance.

Hikkaduwa gala is a rock with a depth of less than 6 feet (1^m8) over it, on a shoal situated about 1½ miles south-south-eastward of Waal islet, and surrounded by depths of from 6½ to 12 fathoms (11^m9 to 21^m9); about a quarter of a mile northward of Hikkaduwa gala is a small 2½-fathom (4^m6) patch.

Dodanduwa is a low point which terminates in two low islets, situated about 2½ miles south-eastward of Waal islet (*Lat.* 6° 08' N., *Long.* 80° 06' E.); the outer of these islets, which is named Manda gala, is continued seaward to a rocky point, 12 feet (3^m7) high, which, with a clump of coconut trees on the inner part, serves to distinguish the locality; the inner islet is named Mada gala. Ratgama lake discharges northward of the point, its entrance being barred by sand except during the wet season. The village of Dodanduwa lies along the road behind the point; there is a Custom-house but very little trade.

Angala are three rocks awash, close to the beach, inside and east-south-eastward of Hikkaduwa gala. Dodanduwa gala is a rock awash, on which the sea always breaks, which lies about 2 cables westward of Manda gala. Orava rock, with a depth of 1½ fathoms

Chart 3700.

(2^m7) over it, is situated about one cable north-north-westward of Dodanduwa gala.

Goda gala, a rocky patch with a depth of 4½ fathoms (8^m2) over it and steep-to, lies about 1½ miles south-westward of Dodanduwa point. 5

Boats can land in fine weather, in the small bay in which is the entrance to Ratgama lake, but the approach is rocky, and there is always considerable surf. This and Ambalangoda are the only places on the coast from Beruwala where it is recommended that boats should land, and then only during the North-east monsoon. 10

*Charts 3700, 819.***Dodanduwa point to Point de Galle.—Coast.—Dangers.—**

Between Dodanduwa point and Point de Galle, about 7½ miles south-eastward, the coast consists of a brown sandy beach with rocky projections at intervals; it is backed by low land with hills rising to elevations of from 140 to 230 feet (42^m7 to 70^m1) about half a mile inland. The whole coastline is thickly planted with coconut trees and the hill slopes are densely wooded. 15

Within, or on the edge of foul ground which fronts this stretch of coast and extends as much as half a mile offshore, are several above-water rocks, but none is particularly conspicuous. 20

Chart 819.

Manuan gala is a rock, 10 feet (3^m0) high, situated close to the beach about 3 miles south-eastward of Dodanduwa. Lihini gala is a rock, 3 feet (0^m9) high, situated about 4 cables south-south-eastward of Manuan gala. 25

Kopata, a rocky shoal with depths of less than 6 feet (1^m8) over it, is charted on the edge of the foul ground about 4 cables westward of Manuan gala.

Gin ganga discharges into the sea about 1½ miles south-eastward of Manuan gala; Gintota Palama, a narrow, sandy spit, fronts the entrance to the river, which finds its exit by a narrow channel round the south-eastern end of the spit during the dry season; during the floods, however, this channel is altered considerably. 30

Bataina gala (*Lat. 6° 03' N., Long. 80° 11' E.*), the first point of any importance south-eastward of Dodanduwa point, is the southern entrance point of Gin ganga; it is 45 feet (13^m7) high, rising behind to 60 feet (18^m3), crowned with coconut trees and is somewhat conspicuous. 35

Pedruana gala, two rocks close together, the outer 3 feet (0^m9) high and flat-topped, the inner 6 feet (1^m8) high and pointed, lie about 4 cables southward of Bataina gala. 40

Boats, and generally canoes, are unable to enter from seaward, on account of the shallow rocky flats and dangers in the surf, but inside, the river is navigable by river boats for about one half of its length. 45

Nindan Godella, a small rocky projection 18 feet (5^m5) high, stands about 1½ miles south-eastward of Bataina gala; it may be known by the Public Works Department bungalow, a white house, on its summit. About 3 cables farther south-eastward is the entrance to Mahámodera lake, usually barred by sand; its position may be identified by an iron girder road bridge which crosses it. The Government hospital, a long building of two storeys with stone pillared verandahs, painted a light buff colour, is about 3 cables south-eastward and not being obscured in any way, is very conspicuous. 50

Charts 3700, 813, 828, 2898, 70.

Chart 819.

Point de Galle, situated about $1\frac{1}{4}$ miles farther south-eastward, is described below.

Heavy rollers occur off this coast throughout the whole distance ; they extend from 2 to 5 cables from it, so that it is impossible for a boat to land at any time, and native canoes can only land in a few favoured places.

Mada gala, a rocky patch with depths of less than 6 feet (1^m8) over it, lies about 2 miles south-westward of Bataina gala ; it is fairly steep-to and is situated at the western end of a bank on which the depths are less than 10 fathoms (18^m3).

Ala gala (*Lat.* $6^\circ 01' N.$, *Long.* $80^\circ 10' E.$), a rock with a depth of less than 6 feet (1^m8) over it, lies about $1\frac{3}{4}$ miles southward of Bataina gala ; the rock is marked by breakers in both monsoons, and should be given a berth of 3 cables when passing.

Alu gala, 3 feet (0^m9) high and steep-to, lies about $1\frac{1}{4}$ miles eastward of Ala gala.

Between these three last-named rocks and the coast are numerous unnamed shoals, the positions of which can best be seen on the chart.

Galu gala, a bank with a least depth of 18 fathoms (32^m9) and much frequented by fishermen, lies about 3 miles south-westward of Point de Galle lighthouse.

Charts 819, 3700.

Directions.—Between Bentota ganga (page 105) and Galle, vessels should keep in depths of over 20 fathoms (36^m6), or about 6 miles from the coast, and at that distance there are few objects for fixing a position ; the most prominent, near the coast, are the monument of Galboda kanda (in the afternoon), (page 105), and Waal islet (page 108), see also view A on chart 3700.

If visible, Hiniduma kanda (page 91) is conspicuous, and Hindelnattu, about $11\frac{1}{2}$ miles east-north-eastward of Point de Galle (page 112), though its summit is ill-defined, forms a valuable mark when eastward of Waal islet ; Yakinige duwa (Katukurundu), an islet which, when seen from westward, appears as a tuft rising over the extreme point of low land eastward of Galle, also forms a valuable mark ; see also page 118.

Chart 819, plans of Galle harbour and Approaches to Galle harbour.

GALLE HARBOUR AND APPROACHES.—**Aspect.**—Point de Galle is the southern extremity of a peninsula projecting half a mile southward from the adjoining coast ; the peninsula forms the western side of Galle harbour which is entered between Point de Galle and Watering point, about one mile east-south-eastward. The town of Galle is built on the southern part of the peninsula and is entirely surrounded by a fortification wall, built by the Dutch during their occupation, and it is joined to the mainland by a low, flat isthmus. There are coconut palms and other trees amongst the houses, but on its western side, the peninsula is clear and covered with grass.

The principal landmarks to be seen when approaching Point de Galle from northward have been described above ; other good marks, in addition to Point de Galle lighthouse and Edwards pillar, see below and view on chart 819, are :—

The clock tower, a square stone erection resembling a factory

Charts 3700, 813, 828, 2898, 70.

Chart 819, plans of Galle harbour and Approaches to Galle harbour. chimney, which stands on the highest part of the peninsula, its top being 141 feet (43^{m0}) high.

The Roman Catholic chapel, a large and very conspicuous building, painted white, with two towers on its front facing the sea, and a dome on the other end, the tops of each being 136 feet (41^{m4}) high ; it stands on a hill a little way behind the town, but on the mainland. All Saints' church, with a square tower, surmounted by a four-sided pointed red roof, and a large weathercock, is in the centre of the town on the point.

The mosque is a large two-storied building, painted white, having two small domes and several low minarets, situated at the south-eastern corner of the point.

Northward of the town, low wooded hills extend for a considerable distance, but the only ones that are likely to be identified by a stranger are Residency hill (*Lat. 6° 02' N., Long. 80° 13' E.*) and Hirimbure kanda ; Residency hill, 203 feet (61^{m9}) high, lies about 3 cables north-eastward of the Roman Catholic chapel ; Hirimbure kanda, 250 feet (76^{m2}) high, conical and with two large banyan trees on its eastern side, is situated 2 $\frac{1}{4}$ miles northward of Point de Galle.

The eastern side of the harbour is formed by Rumassala kanda, a large wooded hill, 245 feet (74^{m7}) high, which slopes down to the sea and is terminated on the harbour side by cliffs, from 60 to 70 feet (18^{m3} to 21^{m3}) high, which become lower towards the southern part ; on the summit of Rumassala kanda is Edwards pillar, 50 feet (15^{m2}) in height and painted black and white.

Watering point, a spur projecting from about half-way down the western side of Rumassala kanda, has a cliffy face on its seaward side, and near its extremity, at an elevation of 100 feet (30^{m5}), is a stone structure, about 10 feet (3^{m0}) in height and painted white ; it is conspicuous, especially in the afternoon sunlight.

On the northern part of Rumassala kanda is a plantation of coconut palms, amongst which are the buildings of Buona Vista orphanage, not easily distinguished ; and at the southern end of the same hill is another plantation, above Unawátuna point, which latter is precipitous, rocky, and from 40 to 50 feet (12^{m2} to 15^{m2}) high.

The head of Galle harbour is a curving sandy beach, broken by two rocky points ; on Gibbet island, the name of the western of these points, situated about 9 cables east-north-eastward of Point de Galle, there are some coconut palms ; on Glosenbergh, the name of the other point, situated about 2 $\frac{1}{2}$ cables farther eastward, there is a large European bungalow.

Behind the points the beach is low and flat, and entirely overgrown with coconut palms, about 80 feet (24^{m4}) high, but on the beach about 5 cables north-westward of Gibbet island a white anchoring beacon will be seen.

The country inland is generally flat, but becomes more hilly northward, and among these hills is Kurundu kanda, flat-topped, 294 feet (89^{m6}) high, and cleared for a tea plantation, situated about 3 miles northward of Gibbet island ; one tall tree left standing, near its western end, is visible from the entrance to the harbour.

About 16 miles north-north-eastward of Kurundu kanda is Hini-duma kanda (charts 3700, 3265), *see* page 91, and on clear mornings in the early months of the year Adam's peak (chart 813) will appear

Charts 3700, 3265, 813, 828, 2898, 70.

Chart 819, plans of Galle harbour and Approaches to Galle harbour. a little eastward of it, as a sharp and regular cone, rising above the surrounding mountains, and flanked by a series of lesser peaks, apparently on the shoulders of its slopes. See view on chart 819.

5 *Chart 819, plan of Galle harbour.*

Point de Galle light.—**Signal station.**—Point de Galle light is exhibited, at an elevation of 93 feet (28^m3), from a white, circular tower, 87 feet (26^m5) in height, situated on Utrecht bastion, the south-eastern extremity of the peninsula, about one cable east-north-
10 eastward of Point de Galle.

There is a signal station at the lighthouse ; it is open for the reception and despatch of messages daily from 0500 to 1800 only.

Bell-buoy.—A bell-buoy, painted in red and white chequers and surmounted by a staff and cage, is moored in the approach to the
15 entrance to Galle harbour, about 9½ cables southward of Point de Galle lighthouse, see view on chart 819.

Outer anchorages.—During the South-west monsoon the best berth is in a depth of 15 fathoms (27^m4), sand, with Point de Galle lighthouse bearing 012°, and Ereminia Gala point, see page 117,
20 bearing 094°.

During the North-east monsoon, vessels usually anchor in depths of 10 fathoms (18^m3), with Kota gala, see page 117, bearing 101° and in line with Ereminia Gala point, and All Saints' church bearing 333° and open north-eastward of the mosque (*Lat. 6° 01' N., Long.*
25 *80° 13' E.*).

Vessels should anchor well clear of Central and Eastern channels and their approaches.

Low-powered vessels approaching Galle harbour should bear in mind that the current sets eastward along the coast during the South-west
30 monsoon and in a contrary direction during the North-east monsoon.

Pilotage.—Pilotage is compulsory for all vessels excepting such as are exempted by authority of the Master Attendant.

The pilot at Galle is the Assistant Master Attendant, who is in charge of the port under the Master Attendant, Colombo. The
35 Assistant Master Attendant is provided with a pilot canoe and a mooring boat ; the pilot canoe is painted white with " Galle Pilot " in black letters on the bow.

The usual signal for a pilot should be displayed on approaching the port and vessels should await the arrival of the pilot as near the bell-
40 buoy as possible. In order to assist the pilot in boarding, a pilot ladder should be let down on the lee side and two manropes of at least 3-inch rope with the ends free, should be provided. Vessels are not brought into harbour at night but should anchor in the outer anchorage as indicated above, until daylight. Vessels can be taken out of
45 harbour at night in fine weather.

Channels.—**Dangers.**—**Buoys.**—There are three channels into Galle harbour, named Western, Central and Eastern channels. Central and Eastern channels are buoyed in accordance with the uniform system, see page 36, starboard hand buoys being painted red and port
50 hand buoys black and white chequers. When vessels are proceeding out of harbour at night, certain buoys are lighted as required by the Assistant Master Attendant.

Western channel.—Western channel is unmarked and is not used except by native craft. It lies between Mee Meti Yawa, a 2½-fathom

Charts 3700, 3265, 813, 828, 2898, 70.

Chart 819, plan of Galle harbour.

(4^m6) patch, about 4 cables south-south-eastward of Point de Galle, on which the sea breaks in heavy weather, and Kadda rocks, about 1½ cables farther south-eastward. Mee Meti Yawa lies at the southern extremity of some extensive foul rocky ground, which fronts the southern part of the peninsula between Point de Galle and Utrecht bastion. On this foul ground, about 2 cables southward of Point de Galle, are Kakoni rocks with Pigeon island and Elephant rock between them and the point. 5

Central channel.—The bell-buoy, *see* above, lies on the western side of the entrance to Central channel. Should this buoy not be in position, a signal to that effect is made from the signal station, but under no circumstances should implicit reliance be placed on the buoys being in the positions assigned to them. 10

In the outer part of Central channel there are depths of from 7 to 9 fathoms (12^m8 to 16^m5) for about three-quarters of a mile northward of the bell-buoy; in the narrowest part, about 4 cables eastward of Point de Galle, there is a depth of 6 fathoms (11^m0), and thence to the anchorage, the depths gradually shoal to 3½ fathoms (6^m9). 15 20

Kadda rocks are three shoal patches lying between 5 and 7 cables south-south-eastward of Point de Galle on the western side of the entrance to Central channel; Outer Kadda rock has a depth over it of 2 fathoms (3^m7); Middle Kadda, a depth of 1½ fathoms (3^m2), and Inner Kadda, a least depth of 2 fathoms (3^m7); during the South-west monsoon the sea breaks heavily over the entire length of these rocks, but during the North-east monsoon there is seldom any disturbance of the surface. 25

Secundra rock (*Lat.* 6° 01' N., *Long.* 80° 13' E.), on which the S.S. *Secundra* struck in 1905, has a least depth of 5 fathoms (9^m1) over it, and lies on the eastern side of the channel about 7 cables south-south-eastward of Point de Galle lighthouse; a red conical buoy is moored on the western side of the rock. 30

Sealark rock, with a depth of 3½ fathoms (6^m4) over it, lies on the western side of the channel, about 5½ cables south-south-eastward of Point de Galle lighthouse; a can buoy, painted in black and white chequers, is moored on the southern side of the rock. 35

Polkote gala, a 3-foot (0^m9) patch on which the sea breaks during the South-west monsoon, lies on the western side of the channel, about 2½ cables south-eastward of Point de Galle lighthouse; a can buoy, painted in black and white chequers, is moored on the south-eastern side of the rock. A 2½-fathom (4^m6) patch lies about 1½ cables south-westward of Polkote gala. 40

Belikatu Wawa, a 2-fathom (3^m7) patch on which the sea breaks in bad weather during the South-west monsoon, lies on the western side of the channel about 2½ cables east-south-eastward of Point de Galle lighthouse; a can buoy, painted in black and white chequers, is moored on the north-eastern side of the patch. 45

Matte Mada, a shoal with a least depth of 5 feet (1^m5) over a rocky head on its western side and with another head with a depth of 1½ fathoms (2^m3) about half a cable south-eastward of it, lies on the eastern side of the channel, about 3½ cables east-south-eastward of Point de Galle lighthouse; the sea breaks over this shoal during the South-west monsoon. A red conical buoy is moored on the western 50

Charts 3700, 3265, 813, 828, 2898, 70.

Chart 819, plan of Galle harbour.

side of Matte Mada. Wara Galwala, a shoal with a least depth of 3 feet (0^m9) over it, and on which the sea usually breaks, lies about 1½ cables east-north-eastward of the shoalest head of Matte Mada.

- 5 Katta gala is a ledge which extends about 2 cables southward from a position about 1¾ cables south-westward of the western point of Gibbet island; it has a least depth of 5 feet (1^m5) in a position about 5 cables north-eastward of Point de Galle lighthouse. Outer Katta, a 4½-fathom (8^m2) patch, lies about one cable south-south-westward
10 of the 5-foot (1^m5) head; a red conical buoy is moored on the western side of this patch. Inner Katta red conical buoy is moored about three-quarters of a cable north-westward of the 5-foot (1^m5) head, in a depth of 4¾ fathoms (8^m7).

- Welihukka is a rocky patch with depths of from 3 to 6 feet (0^m9 to
15 1^m8) over it, lying about one cable eastward of, and parallel with, the fortification wall on the eastern side of the town, between Sailors bastion, about 1¾ cables northward of Point de Galle lighthouse, and Schwarte fort, about one cable farther northward. "Capera" can buoy, painted in black and white chequers, and situated about 1½ cables
20 east-south-eastward of Sailors bastion, marks its southern end, and a similar buoy, situated about 1½ cables east-north-eastward of the same bastion, marks its northern end.

- Eastern channel.*—Eastern channel has a least depth of 6½ fathoms (11^m9) in the fairway as far as its junction with Central channel east-
25 ward of Polkote gala. It is entered between Unawátuna point, the southern extremity of Rumassala kanda (page 111), and Alut ground, with a least depth of 6¼ fathoms (11^m4), situated about 6 cables south-south-westward of Watering point (*Lat.* 6° 01' N., *Long.* 80° 14' E.).

- Gal Pare, consisting of several heads with a least depth of 4¼ fathoms
30 (7^m8), lies on the south-western side of the channel, about 6¾ cables south-eastward of Point de Galle lighthouse; a can buoy, painted in black and white chequers, is moored on the eastern side of Gal Pare. Bloomfield rock, a 4¼-fathom (7^m8) patch, lying about 5½ cables south-eastward of Point de Galle lighthouse, is on the south-western side
35 of Eastern channel and also on the eastern side of Central channel; a spherical buoy, painted in black and white horizontal bands and surmounted by a staff and triangle, is moored on the northern side of Bloomfield rock.

- Imbu Ranne gala consists of several small heads lying on the north-
40 eastern side of the channel, about 3 cables west-north-westward of Watering point; the southernmost head has a depth of 4¾ fathoms (8^m7) and the northernmost, a depth of 4¼ fathoms (7^m8); between them there is a least depth of 3½ fathoms (6^m4). A spherical buoy, painted in red and white horizontal bands, is moored about three-
45 quarters of a cable south-south-eastward of the southernmost head, and a can buoy, painted in black and white chequers, is moored close eastward of the northernmost head. Both of these buoys are removed during the South-west monsoon.

- Diya Mudawa, a shoal with a least depth of 1¾ fathoms (3^m2) over
50 it, lies on the north-eastern side of the channel, about 2 cables north-westward of the shoalest head of Imbu Ranne gala; the sea breaks on it during the South-west monsoon.

Dangers in eastern part of harbour.—There are several detached shoals in the eastern part of the harbour which is entered between

Charts 3700, 3265, 813, 828, 2898, 70.

Chart 819, plan of Galle harbour.

Watering point and Gibbet island, about 8 cables north-north-westward. Kabare gala consists of two rocks situated, respectively, about $3\frac{1}{2}$ and 4 cables, southward of Gibbet island and about 2 cables eastward of Wara Galwala; there is a depth of $2\frac{3}{4}$ fathoms (5^m0) over the northern, and of 5 fathoms (9^m1) over the southern, rock. 5

Meeyanne gala and Bokalossawa gala, with least depths of $4\frac{1}{2}$ and $3\frac{3}{4}$ fathoms (8^m2 and 6^m9) respectively, over them, lie on the outer edge of the shorebank, about $3\frac{1}{2}$ cables northward of Watering point.

Ketti Paramane is a $2\frac{1}{4}$ -fathom (4^m1) patch situated about 2 cables southward of Gibbet island; Gommoliya rocks lie in the north-eastern corner of the harbour, about $2\frac{3}{4}$ cables eastward of the eastern point of Gibbet island. 10

Head of harbour.—Dangers.—The head of the harbour is entered between Schwarte fort and the western point of Gibbet island, about 6 cables eastward, and it extends about 4 cables northward. 15

A $3\frac{3}{4}$ -fathom (6^m9) patch lies about $2\frac{1}{4}$ cables westward of the western point of Gibbet island. An gala, a $1\frac{1}{2}$ -fathom (2^m7) patch, lies about $1\frac{1}{2}$ cables north-north-westward of the same point.

Diyamba Lihini, a rock 4 feet (1^m2) high, lies about $1\frac{1}{2}$ cables north-north-eastward of Schwarte fort; Kesbara gala, with a depth of $1\frac{3}{4}$ fathoms (3^m2) over it, lies about 3 cables north-eastward of the same point. Kamba Bandina gala, Kawadi Duwa and Goda Lihini gala, situated close inshore on the western side of the head of the harbour, consist of above-water and sunken rocks, the positions of which may best be seen on the chart. 20

Anchorage.—Beacon.—Buoy.—In May and June, very disturbed conditions with a swell as much as 14 feet (4^m3) high, may be experienced in the harbour and sometimes last for three days. 25

There are eight anchorage berths during the North-east monsoon, 30 of which one is available for a vessel 500 feet (152^m4) in length and of 30 feet (9^m1) draught, under suitable weather conditions. During the South-west monsoon, there are six anchorage berths, one of which is available for a vessel 450 feet (137^m2) in length and of 26 feet (7^m9) draught. The two innermost berths, available in either monsoon, 35 are for vessels up to 300 feet (91^m4) in length and of 15 feet (4^m6) draught.

A white cage beacon, 30 feet (9^m1) high, stands on the beach at the head of the harbour, about 5 cables north-north-eastward of Schwarte fort (*Lat. $6^\circ 02' N.$, Long. $80^\circ 13' E.$*); a red conical buoy is moored about one cable southward of the beacon. This beacon bearing 352° indicates the line on which vessels in the western berths should place their eastern port anchors. The bottom at the anchorage is sand and mud with good holding ground. 40

Vessels moor head and stern using both bower anchors, open hawse southward, the stern moorings being laid by the Assistant Master Attendant. Some of these moorings are laid as required and others are kept ready with their ends secured to small white conical buoys. By Port regulations, vessels are required to be ready to veer cable when required to do so by the Assistant Master Attendant and are not to blow main boilers down without his permission. 50

During the North-east monsoon there is also good anchorage for vessels up to 500 feet (152^m4) in length and 30 feet (9^m1) draught, with Watering point bearing 162° , distant 2 cables.

Charts 3700, 3265, 813, 828, 2898, 70.

Chart 819, plan of Galle harbour.

Directions.—If entering by Central channel, from a position about $1\frac{1}{2}$ cables eastward of the bell-buoy, *see* view on chart 819, vessels should follow the recommended track which is indicated by a pecked line on the chart; if anchoring in the western berths, course should be altered round the black and white chequered buoy marking Belikatu Wawa to bring the white cage beacon on the beach at the head of the harbour to bear 352° .

Before reaching the anchorage berth speed should be reduced to a minimum consistent with retaining command of the vessel.

If entering by Eastern channel, having rounded the dangers off Unawátuna point (page 111), vessels should bring the northern end of Kachcheri, a conspicuous buff-coloured building, situated about $1\frac{1}{2}$ cables northward of Utrecht bastion, in line with the Roman Catholic chapel, bearing 322° , and steer in, keeping this bearing on until Central channel is reached, when the directions given above should be followed.

Piers.—There are three concrete piers, each carrying a depth of 6 feet (1^m8) for about 100 feet (30^m5) from its outer end, situated at the northern end of the town, between half a cable and one cable westward of Schwarte fort.

No. 1, which is 290 feet (88^m4) in length, is the best sheltered and is used for landing and embarking passengers and cargo; it is fitted with a derrick.

Nos. 2 and 3 are 214 and 250 feet (65^m2 and 76^m2) in length, respectively; they are used for landing and embarking cargo, and are each fitted with two 2-ton hand cranes.

Lights.—Leading lights are exhibited from No. 1 pier (*Lat.* $6^\circ 02' N.$, *Long.* $80^\circ 13' E.$), and in line, bearing 237° , indicate the channel of approach to the piers for boats and lighters.

Quarantine.—Vessels not having properly qualified medical officers, are prohibited from having communication with the shore, nor is any person, other than the pilot, allowed to board them until permission is obtained from the health officer; under no circumstances are cases of infectious disease allowed to be landed without the consent of the Government health officer.

The regulations governing vessels having plague, cholera, or yellow fever on board, and the signals required from all vessels arriving off the port, are the same as those for Colombo. *See* page 99.

Town.—The town of Galle, enclosed by a wall, is entered by two gates, one facing the landing-place, and the other on the northern side, leading to the flat, grassy isthmus, now the racecourse. The principal buildings have already been described.

Other buildings, conspicuous after entering the harbour, are the hotel, a large, two-storeyed house, standing on high ground on the eastern side of the town; next to it is an old Dutch church, with two high ornamental gables, which is painted white, but its south-western side has become blackened by the weather.

The native town and the bazaar stretch along the main coast road for about 2 miles east and west of the racecourse. The Government Agent's official residence, on the summit of Residency hill, is completely obscured from the harbour by trees.

The site of the present town was that of a fishing village in 1505, which was fortified by the Portuguese, who built a wall across the

Chart 819, plan of Galle harbour.

isthmus, the present wall and fortress being added by the Dutch in 1667; the fortress was surrendered to the British in 1795.

In 1931, the population of Galle was 38,424.

Port facilities.—Coal and fuel oil are kept in stock in small quantities for local purposes and might be obtainable. 5

Water is laid on at No. 1 pier, and there is one 25-ton water lighter; supplies of water are limited in April and May.

Fresh provisions are obtainable. Cargo is landed and embarked in open lighters of about 12 tons capacity. 10

There is a Government hospital to which seamen are admitted.

Health.—The climate is most trying during March and April, before the break of the South-west monsoon, but at no time can it be considered unhealthy.

Life-saving.—Two Pulling lifeboats and one Power lifeboat are 15 maintained.

Communication.—There is frequent sea communication with Colombo, and other ports in Ceylon, and thus with India and all parts of the world.

Trade.—The principal exports consists of coconut products 20 citronella oil, tea, cinnamon, and plumbago; the chief imports are coal, sugar, rice and other grain.

Winds.—See Percentage frequency of wind direction at coast stations, page 87.

Chart 819.

25

GALLE HARBOUR TO DONDRA HEAD.—Watering point to Ereminia Gala point.—Coast.—Off-lying dangers.—Between Watering point and Unawátuna point, about one mile south-eastward, the coast is steep and rocky; eastward of the latter point it recedes to form a small sandy bay on the shores of which are some houses 30 standing among coconut palms. At the eastern end of this bay, about half a mile east-north-eastward of Unawátuna point, is a large white house which is a good landmark.

A reef of rock and coral, nearly awash, extends across the mouth of the bay, widening eastward and with a gap at its western end 35 through which canoes can pass to the shores of the bay.

From the large white house, the coast trends south-eastward for about three-quarters of a mile to Ereminia Gala point, a large black rock with a pointed top about 20 feet (6^m1) high; about 2 cables farther east-south-eastward and near high water mark, is another 40 large boulder, 30 feet (9^m1) high, and moderately prominent, the beach between them being sandy and backed by coconut palms.

For about a quarter of a mile south-eastward of the large white house, the coast is faced with a sea wall for the preservation of a road which here runs along the edge of the coast. 45

The whole stretch between Unawátuna point (*Lat.* 6° 00' N., *Long.* 80° 15' E.) and Ereminia Gala point is fronted by numerous rocks and much foul ground. Goda gala, a rocky patch with a depth of less than 6 feet (1^m8) over it, and on which the sea always breaks, is situated about 6 cables south-south-eastward of Unawátuna point 50 and is the outermost danger of this foul ground and also in the eastern approaches to Galle harbour. Kota gala and Deumba gala, two rocks, 14 and 12 feet (4^m3 and 3^m7) high, respectively, lie between

Chart 819.

Goda gala and Unawátuna point. Gona gala, a rock awash, lies about 3 cables eastward of Kota gala and a ledge of blackish rock about 8 feet (2^m4) high, extends southward from the reef to a position 5 about 1½ cables eastward of Gona gala.

Charts 3700, 3265.

Ereminia Gala point to Rassamunai point.—Coast.—Dangers.

—Between Ereminia Gala point and Yakinige duwa (Katukurundu islet), about 7½ miles east-south-eastward, the coast consists of a 10 slightly irregular sandy beach backed by a thick belt of coconut palms, through which runs the railway between Galle and Matara, *see* page 122. The whole of this stretch of coast is fronted by reefs and foul ground on which the sea always breaks, which, in places, extends as much as 3½ cables offshore. Outside the breakers, the depths are 15 somewhat irregular, but with the exception of a 5-fathom (9^m1) patch, surrounded by depths of 9 and 10 fathoms (16^m5 and 18^m3), which lies about 3 miles westward of Yakinige duwa and about 6½ cables offshore, there are apparently no actual off-lying dangers.

Talpe railway station is situated close within the coast, about three- 20 quarters of a mile eastward of Ereminia Gala point. About 1½ miles northward of Talpe station is Malagoda kanda, a conical hill, 304 feet (92^m7) high, with a prominent tree on its summit and a shoulder extending south-westward, the summit of which is also prominent.

Koggala is a fresh-water lake lying close within the coast with a 25 small outlet about 4½ miles east-south-eastward of Ereminia Gala point; the outlet may be identified by Kotavanni, a solitary black rock, 50 feet (15^m2) high, situated about 3½ cables westward of it and moderately prominent. Debaha rock, lying about three-quarters of a mile south-eastward of the outlet and about 3 cables offshore, is 30 3 feet (0^m9) high and small, and has depths of from 4½ to 6 fathoms (8^m2 to 11^m0) around it.

About one mile westward of Kotavanni is a landing place for canoes and another may be reached through the reef about half a mile east-south-eastward of that rock.

35 About 2 miles inland, northward of Koggala lake, hilly country commences and gradually rises to Hindelnattu, about 8 miles north-north-eastward of the lake; this mountain is 1,344 feet (409^m6) high, with a large, rounded summit and a small pointed shoulder on its north-eastern side; when once identified it forms an excellent land- 40 mark all round the southern and western coasts.

Yakinige duwa (Katukurundu) (*Lat. 5° 58' N., Long. 80° 23' E.*) is an islet with steep, cliffy sides and is joined to the mainland by a causeway; the trees on the islet are 130 feet (39^m6) high and have tufted tops. A prominent reddish cliff, from 70 to 100 feet (21^m3 to 45 30^m5) high, with boulders at its foot, projects from the coast about 6 cables westward of the islet, and a rocky reef with some above-water heads, extends about 2 cables south-eastward from it.

Chart 3265.

Between Yakinige duwa and Rassamunai (Rasamunai) point, the 50 western entrance point of Weligama bay, about 2½ miles east-south-eastward, the coast consists of a sandy beach backed by coconut palms, with the road running close to it until within about half a mile of the point, when the land rises to terminate in red cliffs which form a prominent mark. Off this stretch of coast the shore reef runs close

Charts 813, 828, 2898, 70.

Chart 3265.

to the beach except at about one mile eastward of Yakinige duwa, where it extends as much as $1\frac{3}{4}$ cables offshore.

Charts 3730, plan of Weligama bay, 3265.

Weligama bay.—General remarks.—Weligama bay is entered 5
between Rassamunai point and Mirissa point, about $1\frac{1}{2}$ miles east-
south-eastward, and the bay extends about $1\frac{1}{2}$ miles north-north-
eastward from the entrance. Rassamunai point consists of red cliffs
which extend about half a mile westward of the point and about
3 cables north-north-eastward of it to Weligama point. From this 10
latter point a sandy beach backed by coconut palms extends around
the head of the bay to the mouth of Polatu ganga in the north-eastern
corner of the bay, about $2\frac{1}{4}$ miles east-north-eastward; this beach is
broken by a cliffy point about 4 cables northward of Weligama point,
on which is a small white house. 15

Mirissa point is the western extremity of a moderately high peninsula
which is partly covered with coconut palms; Kola point, the southern
extremity of the peninsula, lies about $6\frac{1}{2}$ cables east-south-eastward
of Mirissa point. Between Mirissa point and Wera point, a cliffy
point 90 feet (27^m4) high, about three-quarters of a mile north-east- 20
ward, the coast curves and forms a sandy bight, at the head of which
is Mirissa village. Between Wera point and Kada point, the southern
entrance point of Polatu ganga, about 4 cables north-north-eastward,
the eastern shore of the bay is cliffy, of moderate height and red in
colour. 25

Behind the head of the bay, the land is so low that it is not visible
from the bay, but hilly country, commencing about 3 miles inland
and extending to Hindelnattu, about 9 miles north-north-westward
of the head of the bay, may be seen over the coconut palms, and in
clear weather, Gongala, 4,445 feet ($1,354^m8$) high, and situated about 30
28 miles north-north-eastward of the head of the bay, is visible above
the intervening hilly ridges.

Chart 3730, plan of Weligama bay.

Light.—Islets and dangers.—A light for the use of fishing craft
is exhibited, at an elevation of 30 feet (9^m1), from a grey concrete 35
column, situated on the western shore of the bay, about half a mile
north-north-eastward of Weligama point (*Lat.* $5^{\circ} 57' N.$, *Long.*
 $80^{\circ} 25' E.$).

There are numerous islets and dangers in the bay and its approaches,
and it should be noted that a south-westerly swell may break on any 40
shoal patch which has not a greater depth than 3 fathoms (5^m5)
over it.

Yala rock, in the western approach to the bay, about half a mile
south-westward of Rassamunai point, has a least depth of $1\frac{1}{2}$ fathoms 45
(2^m7) over it and is steep-to.

A reef with a few rocky above-water heads on it and on which the
sea always breaks, fronts the coast around Rassamunai point for
about half a mile westward and about 6 cables northward, of the
point, and extends from 2 to 3 cables offshore. Pares shoal, situated
about half a mile east-south-eastward of Rassamunai point, has a least 50
depth of $2\frac{1}{2}$ fathoms (4^m6) over it; between this shoal and the edge
of the reef fronting Rassamunai point, the depths are very irregular.

Sealark rock, a $4\frac{3}{4}$ -fathom (8^m7) patch, lies about $7\frac{1}{2}$ cables east-
south-eastward of Rassamunai point and about $8\frac{1}{2}$ cables eastward

Chart 3730, plan of Weligama bay.

of Pares shoal ; there are depths of from $5\frac{1}{4}$ to 7 fathoms (9^m6 to 12^m8) between the shoal and the rock.

On the eastern side of the approach to the bay, the coast between
5 Mirissa point and Kola point is fronted to a distance of about 2 cables by foul ground on which the sea always breaks and on which are numerous rocks both sunken and above-water ; a $2\frac{3}{4}$ -fathom (5^m0) rocky patch lies about $2\frac{1}{4}$ cables south-south-eastward of Kola point.

Palapana gala, shoal rocky ground on which the least depth is
10 $3\frac{3}{4}$ fathoms (6^m9), lies about 4 cables southward of Mirissa point.

Diyumba Alut rock, with a depth of $2\frac{3}{4}$ fathoms (5^m0) over it and on which the sea occasionally breaks, lies on the eastern side of the entrance, about 3 cables westward of Mirissa point ; it is the shoalest point of a rocky ridge, with depths of less than 5 fathoms (9^m1) over
15 it, and there are depths of 5 and 6 fathoms (9^m1 and 11^m0) between the ridge and the point.

Kada rock, a $2\frac{1}{2}$ -fathom (4^m6) patch, is situated near the middle of the entrance to the bay, about 7 cables west-north-westward of Mirissa point ; the fairway of the entrance channel lies between
20 Kada rock and Diyumba Alut rock. Karamas rock, with a depth of $3\frac{3}{4}$ fathoms (6^m9) over it, lies about 9 cables eastward of Rassamunai point and about 4 cables northward of Kada rock (*Lat.* $5^\circ 57' N.$, *Long.* $80^\circ 26' E.$).

Diyumba rocks, a group of rocks with a least depth of $1\frac{1}{4}$ fathoms
25 (2^m3) over them, are situated between 5 and $6\frac{1}{2}$ cables northward of Mirissa point ; the westernmost rock has a depth of $2\frac{3}{4}$ fathoms (5^m0) over it, and the northernmost one, 2 fathoms (3^m7).

Prompt shoal, situated near the middle of the bay about one mile westward of Kada point, has a depth of $2\frac{3}{4}$ fathoms (5^m0) over it ;
30 Puhumodal rock, about $2\frac{1}{4}$ cables north-north-westward of Prompt shoal, has a least depth of $1\frac{1}{2}$ fathoms (2^m7) over it.

Great and Little Bolo rocks, 8 feet (2^m4) and 3 feet (0^m9) high, respectively, lie about 3 cables north-eastward of Prompt shoal.

Between the above-named rocks and shoals and the shore of the
35 bay are numerous rocks and shoals, amongst which are :—Kapuruwana, Kotaha, Ratapane and Modere Payan rocks, the positions of which may best be seen on the chart.

Ruwana rock, about $3\frac{1}{2}$ cables east-north-eastward of Weligama point, is 6 feet (1^m8) high ; a rocky head awash lies close eastward
40 of the rock.

Rose (Gan) island, nearly connected to the coast at low water by a sandy spit, lies about $1\frac{1}{4}$ cables east-north-eastward of the light-structure ; being planted with coconut palms, it is not easily distinguished from the coast westward of it. Wahu rock, about half a cable
45 southward of Rose island, dries one foot (0^m3).

Parei duwa (Pigeon island), lying a quarter of a mile offshore at the head of the bay, is rocky and covered with scrub ; it may be identified by its having no coconut palms on it. (*See view on chart 3730.*) Mora rock is a rock awash, about three-quarters of a cable southward
50 of Parei duwa. Virumba rock, about 2 cables north-westward of Parei duwa, is 23 feet (7^m0) high.

In addition to the above-named rocks and shoals there are numerous unnamed ones, the position of which can best be seen on the chart.

Anchorage.—Directions.—Anchorage may be obtained either

Charts 3265, 813, 828, 2898, 70.

Chart 3730, plan of Weligama bay.

south-eastward of Ruwana rock, in depths of from 5 to 6 fathoms (9^m1 to 11^m0), sand and rock, or, for vessels of moderate draught, in similar depths in the south-eastern part of the bay, off Mirissa village. A good berth off the village is with the red cliff on Kada point bearing 039° and Ruwana rock bearing 294°.

Although no reliable information has been obtained, it is probable that the former anchorage may be used during the South-west monsoon. The anchorage off Mirissa village was used by the surveying vessel in the months of January and February, and good shelter was obtained from the swell which was setting into the former anchorage.

Vessels approaching from westward must avoid Yala rock, and those from eastward should pass southward of Prinz Heinrich patch for which clearing marks are given below. Vessels should proceed into Weligama bay with Parei duwa in line with a gap in the hills in rear, bearing 352°, see view on chart 3730, which passes about 1½ cables westward of Diyumba Alut rock and about 1½ cables eastward of Kada rock; when these dangers are passed, course may be shaped for the anchorage off Mirissa village.

If proceeding to the anchorage south-eastward of Ruwana rock, vessels should enter the bay on the same leading marks and should pass eastward and northward of Karamas rock.

Town.—The town of Weligama, which in 1931 had a population of 9,751, is situated on the north-western side of the bay and is somewhat scattered; it is connected with the railway system of Ceylon. The best landing place is on the south-western side of the drying sandy spit which extends from the coast towards Rose island. There is a rest-house close westward of the light-structure (*Lat.* 5° 58' N., *Long.* 80° 25' E.).

Chart 3265.

Current.—The currents are weak and generally set parallel with the coast, but see pages 122 and 126.

Mirissa point to Galgodiya.—**Coast.**—**Dangers.**—Between Mirissa point and Galgodiya (Chula Lanka), an islet close inshore about 5½ miles eastward, the coast is densely wooded with coconut palms and appears moderately high. There are several dagobas which show up well under favourable conditions of light, but at other times are often difficult to distinguish.

Off this stretch of coast, the bottom is rocky and uneven in depths of less than 5 fathoms (9^m1), and for purposes of ordinary navigation vessels should keep in depths of over 20 fathoms (36^m6), passing about 1½ miles southward of Veragalle point.

Veragalle point is a rocky point situated about half a mile eastward of Kola point; between these points is a sandy bight from the western part of which a rocky ledge, about 10 feet (3^m0) high at its highest part, extends about one cable offshore.

Prinz Heinrich patch is a large rocky patch with a least depth of 4 fathoms (7^m3) over it, situated about one mile south-south-westward of Veragalle point; depths of from 6 to 10 fathoms (11^m0 to 18^m3) extend for about half a mile eastward of the patch.

Galgodiya in line with Brown's hill, see page 122, bearing 074°, leads southward of Prinz Heinrich patch and Mirissa point in line with Hindelnattu (page 118) bearing 347°, leads westward of it.

Talarambee point is a rocky and slightly elevated point about

Chart 3265.

4 cables eastward of Veragalle point ; close behind it is a white dagoba, the top of which is 120 feet (36^m6) high, and shows above the tree-tops. Kalcotta rocks, three heads from one to 2 feet (0^m3 to 0^m6) high, lie about a quarter of a mile southward of Talarambee point.

Atalahua point, about one mile eastward of Talarambee point, is low and inconspicuous ; Tanana rocks, from 3 to 5 feet (0^m9 to 1^m5) high, lie about a quarter of a mile southward of Atalahua point. About midway between Kalcotta and Tanana rocks, is a rock, nearly
10 awash.

Moolkalle point, about one mile eastward of Atalahua point, is rocky and contrasts somewhat with its surroundings on account of being covered with low bushes instead of coconut palms. Korolamba point, about one mile farther eastward, is scarcely distinguishable as
15 a point. Katahella rock, a rock awash, lies about a quarter of a mile south-westward of Korolamba point.

Galgodiyana (Chula Lanka), about three-quarters of a mile eastward of Korolamba point, is an islet, 73 feet (22^m3) high, covered with coconut palms and connected with the coast by a causeway in a very
20 poor state of repair. Several rocks, two of which are from 7 to 8 feet (2^m1 to 2^m4) high, lie about 3 cables southward of the islet with depths of 1½ fathoms (2^m7) between.

Matara bay.—Dangers.—Matara bay, formed by the curving coastline between Galgodiyana and Dondra head, about 3½ miles
25 east-south-eastward, is mostly foul and is entirely open southward.

Madumora reef, with depths of less than 6 feet (1^m8) over it on its northern edge, and with a least depth of 1½ fathoms (2^m7) near its southern edge, is situated in the western part of the bay, about three-quarters of a mile south-eastward of Galgodiyana.

30 Sleet rock, about 1½ miles west-south-westward of Dondra head, is the outermost danger in the eastern part of the bay, and has a depth of 5½ fathoms (10^m1) over it.

Nilwala ganga flows into the sea about half a mile north-eastward of Galgodiyana ; the opening in the sand, through which it enters
35 the sea, was only 30 yards (27^m4) wide in 1908. There are several sunken rocks immediately in front of the river-mouth, and close to are others which are from 4 to 10 feet (1^m2 to 3^m0) high.

Matara town (*Lat.* 5° 57' N., *Long.* 80° 32' E.), which is of considerable size and next in importance to Galle in the southern provinces,
40 is situated at the head of the bay, but very little of the town is visible from seaward ; the clock tower, however, shows up well between the bearings of 347° and 302° in a favourable light. Matara is the residence of an Assistant Government Agent. In 1931, the population was 18,893.

45 An islet, 41 feet (12^m5) high, is connected to the foreshore just eastward of the clock tower, by a causeway on which the sea generally breaks ; nearly a mile farther eastward are some prominent red cliffs, the highest of which is 122 feet (37^m2) high, and behind these cliffs is Brown's hill, 169 feet (51^m5) high, which may be identified by
50 a red triangular patch on its south-western slope.

Currents.—The currents are irregular within 2 miles of the coast and, westward of Dondra head, there is often an indraught into Matara bay for which allowance must often be made.

Dondra head. — Light. — Beacon. — Landing. — Dondra head,

Chart 3265.

the southernmost point of Ceylon, is low with a grove of tall coconut trees on it; its western extremity, although connected with the mainland by a rocky ledge, appears as an islet.

A light is exhibited, at an elevation of 152 feet (46^m3), from a white octagonal tower, 160 feet (48^m8) in height, situated near the eastern extremity of Dondra head.

A white pyramidal beacon stands on the coast at an elevation of 45 feet (13^m7), about 4½ cables north-eastward of Dondra head lighthouse.

Canoes pass over the sunken reef and land either on the beach or alongside the causeway at Matara, but this is seldom practicable in ship's boats. The safest place to land, in a ship's boat, is on the northern end of the west beach in the first small bay just northward of the lighthouse (*Lat.* 5° 55' N., *Long.* 80° 36' E.). This bay is rocky, and has a reef running across it from near the lighthouse, but there is always sufficient depth over it for a ship's boat. An anchor should always be used over the stern of the boat to keep the boat from being driven too violently on to the beach by the swell. The sandy bay next this, north-eastward, looks more inviting, as the beach is sandy, but it is not so safe on account of the swell, and is not recommended for landing.

DONDRA HEAD TO HAMBANTOTA POINT.—General remarks.—Between Dondra head and Hambantota point, about 84 miles east-north-eastward, the coast is low generally and has both sandy and rocky stretches; there are no dangers to navigation outside a distance of 1½ miles offshore. The westernmost part of this stretch of coast, between Dondra head and Nilewelli point, about 8 miles east-north-eastward, has a somewhat elevated appearance owing to the low-lying parts being covered with coconut palms. From Nilewelli point for about 6 miles north-eastward to Tangalla point, the coast becomes generally rocky and is of moderate height and indented by several bays. Eastward of the latter point it again becomes low and sandy and is backed by coconut palms as far as Kalametiya point, about 9 miles east-north-eastward; thence to Hambantota point, about 12 miles farther east-north-eastward, it is mostly low, barren and sandy and is interrupted only by a few cliffy points.

Dondra head to Nilewelli point. — Coast. — Dangers. — Between Dondra Head lighthouse and Gandura point, a rocky point about 1½ miles east-north-eastward, the coast is composed of rocky cliffs which are about 100 feet (30^m5) high in one part. A prominent banyan tree, 190 feet (57^m9) high, stands near the coast about half a mile westward of Gandura point, and close off the coast in front of it is a detached reef of rock, 8 feet (2^m4) high at its highest part. Another prominent banyan tree, the top of which is 225 feet (68^m6) high, is situated about half a mile northward of Gandura point. Gandura village is situated behind the sandy beach, immediately northward of Gandura point.

Gandura bay lies between Gandura point and Kottagoda point, a rocky point with boulders, about 1½ miles east-north-eastward. The shores of the bay are moderately high and rocky, and fringed with reef which is broken for about half a mile by Nuroni cove, in which there is a sandy beach and some coconut trees.

Chart 3265.

There is good anchorage in the western part of Gandura bay, in a depth of 10 fathoms (18^m3), sand, with Gandura point bearing 248° , distant $5\frac{1}{2}$ cables, but it is not protected from the swell.

- 5 Landing was easily effected here in December during the survey.

Etawa reef, with a least depth of 2 fathoms (3^m7), lies about one mile eastward of Kottagoda point, and Bambri rocks, 4 feet (1^m2) high, lie about half a mile north-eastward of Etawa reef; there are several sunken rocks close to Bambri rocks. The western extremity of the beach in Nuroni cove, bearing 271° , open well southward of the south-western extremity of Kottagoda point, leads southward of Etawa reef (*Lat. $5^\circ 57' N.$, Long. $80^\circ 39' E.$*).

- Gull rocks, the highest of which is 20 feet (6^m1) high, extend about $1\frac{1}{2}$ cables eastward of Kottagoda point, inside which is a small sandy bight; Kottagoda village stands behind this sandy bight.

Dikwella bay is entered 3 miles east-north-eastward of Kottagoda point; Dikwella village, in which is a rest house, stands close behind the beach of this bay, but the bay is inaccessible for boats on account of a reef across its entrance.

- 20 Nilewelli point is steep-to and rocky with a clump of coconut palms, 80 feet (24^m4) high on it; the point is connected with the mainland by a narrow strip of sand, over which the surf washes in a moderate swell, and, when seen from eastward or westward, it appears as an islet.

- 25 Walakanda (Waulugala), a hill with a bare summit, 555 feet (169^m2) high, situated about $3\frac{1}{4}$ miles northward of Nilewelli point, forms a good mark for vessels coasting, but is not so conspicuous to vessels farther offshore, owing to there being other hills behind it. *See view facing page 126.*

- 30 **Nilewelli bay.—Anchorage.**—Nilewelli bay lies between Nilewelli point (*Lat. $5^\circ 57' N.$, Long. $80^\circ 43' E.$*) and the southern extremity of a rocky peninsula, of which Kolonna point is the eastern extremity, situated about one mile north-eastward of Nilewelli point; there are two detached rocks off the southern extremity of the rocky peninsula, 35 remarked on above, the western being 8 feet (2^m4) and the eastern 4 feet (1^m2) high. A white dagoba is situated about one mile northward of Nilewelli point. The north-eastern part of the bay is foul.

Anchorage may be obtained, in depths of from 8 to 10 fathoms (14^m6 to 18^m3), sand, about 4 cables north-eastward of Nilewelli point.

- 40 **Kolonna point to Tangalla point.—Coast.—Dangers.**—Mahawelli point is the eastern extremity of a steep and rocky peninsula, of moderate height and nearly bare of trees, situated about one mile north-eastward of Kolonna point. In the western part of the bight formed between these two points is Sureya Tree bay, a small sandy bay where small coasting craft anchor close to the beach in depths of 5 fathoms (9^m1), sand.

- Mahawelli bay, immediately northward of Mahawelli point, affords anchorage, in depths of from 5 to 8 fathoms (9^m1 to 14^m6), sand, to vessels with local knowledge, close northward of Mahawelli rock, 50 a rock, awash, lying about 2 cables eastward of the point, with depths of 7 fathoms (12^m8) between.

Middle rock, which is nearly awash and always breaking, lies about 5 cables east-north-eastward of Mahawelli rock, and the anchorage is approached between the two rocks. Unaeria rocks are four distinct

Chart 3265.

heads, 6 feet (1^m8), 5 feet (1^m5), 3 feet (0^m9) and one foot (0^m3) high, respectively, lying close eastward of Middle rock.

On Tangalla (Tangalle) point is the town of Tangalla (Tangalle), which had a population of 5,204 in 1931, and an old white fort which is conspicuous. A rocky ledge extends in an easterly and south-easterly direction from the point. 5

Tangalla bay.—Dangers.—Tangalla bay is entered between Tangalla point and Rekawa point, a rocky, barren point about 50 feet (15^m2) high, about 4 miles eastward. The coast between is low and sandy, backed by coconut trees and fronted by a considerable amount of rocky reef, just below water. The entrance to Kunkalle ganga, which is usually blocked, is about half a mile northward of Tangalla point. Rekawa point is fringed by a reef which extends about a quarter of a mile offshore. 10 15

Tangalla rock, awash and steep-to on its southern and eastern sides lies one mile eastward of Tangalla point. Kadul rock, with a depth of 1½ fathoms (3^m2) over it, lies 2 cables north-north-westward of Tangalla rock. Ma rock, with a depth of 2½ fathoms (4^m6), and Nakatta rock, with a depth of 1½ fathoms (2^m3), lie about 1¼ miles eastward and 4 cables north-eastward, respectively, of Tangalla point. 20

The best landing place is 1½ cables southward of the entrance to Kunkalle ganga.

Directions.—Anchorage.—To enter Tangalla bay a vessel should pass about half a mile eastward of Tangalla rock, and then steer about 021° until the coconut trees on the south-western bank of the entrance to Kunkalle ganga are in line with the small white dagoba, situated half a mile north-westward of the fort, bearing 265°, when she should steer in on this line and anchor in depths of from 5 to 6 fathoms (9^m1 to 11^m0), with Tangalla rock bearing between 167° and 149°. The dagoba is very difficult to identify with the sun in the west. 25 30

Rekawa point to Kalametiya point.—Coast.—Dangers.—Between Rekawa point and Kalametiya point, the coast is backed by a long line of coconut trees and midway between these points is Kahandawa point (*Lat.* 6° 04' N., *Long.* 80° 54' E.). 35

Kahandawa rocks, 2 feet (0^m6) high, lie southward of Kahandawa point, the inner rock being on the edge of the coastal reef, and the outer about three-quarters of a mile from the point. A rocky head, with a depth of 4½ fathoms (8^m7), lies about 3 cables southward of the rocks. A sunken reef extends offshore for more than a mile eastward of Kahandawa point, lying over half a mile offshore at about one mile south-westward of Kalametiya point. 40

Kalametiya point, which is moderately high and rocky, terminates in a large boulder, from which a chain of rocky islets extends in a south-easterly direction; Watta rock, a barren islet 24 feet (7^m3) high, is the south-eastern extremity of this chain of islets, from which it stands out somewhat conspicuously on account of the light colour of its upper part. 45

Kalametiya rock, of which a small pinnacle just shows, lies nearly 4 cables eastward of Kalametiya point. 50

Several rocky patches, over which there are depths of 4 and 5 fathoms (7^m3 and 9^m1), lie within half a mile of Watta rock south-westward, southward and eastward of that rock; a sunken rock, on which the sea generally breaks, lies about 3 cables south-eastward of Watta rock.

Chart 3265.

Anchorage may be obtained by vessels with local knowledge from 3 to 5 cables east-north-eastward of Watta rock, in depths of from 5 to 7 fathoms (9^m1 to 12^m8), sand and rock.

- 5 **Kalameitiya point to Hambantota point.—Coast.—Dangers.**—Between Kalameitiya point and Ulandhe point, a steep, red cliffy point, 2½ miles eastward, there is a sandy beach with some low scrub and a lagoon close inland; the summit over Ulandhe point is 60 feet (18^m3) high; the depths are very irregular over a rocky bottom for
10 more than half a mile off the coast between these points. Swell rock, with a depth of 3½ fathoms (6^m9), and which breaks in a moderate swell, lies about one mile westward of Ulandhe point.

- Rattan point, which is similar to Ulandhe point, lies about three-quarters of a mile eastward of it; between them are two sandy bights,
15 separated by a sloping point with a rocky ledge extending from it. Rocks extend nearly 4 cables offshore between these points, one, 15 feet (4^m6) high, and black, being about one cable southward of Rattan point.

- Between Rattan point and Godawaye (Godawayaya) point (*Lat.*
20 6° 06' N., *Long.* 81° 03' E.), about 3½ miles eastward, is a sandy beach which for the first mile is backed by coconut palms, and for the remainder by low hills and scrub. About 1½ miles east-north-eastward of Rattan point is the entrance to Walawe ganga, usually a very small opening in the sandy beach.

- 25 Godawaye point is 50 feet (15^m2) high and rocky; there is a white dagoba within the point and, immediately eastward of it, a reef awash.

Ibha rock, with a depth of less than 6 feet (1^m8) over it, and steep-to, lies about three-quarters of a mile southward of Godawaye point. The sea does not always break on this rock.

- 30 Nehindi rock, awash and steep-to, lies about two miles east-south-eastward of Godawaye point, and about one mile offshore.

Veralawinha point lies about 2½ miles eastward of Godawaye point; between these points, and eastward to Hambantota, the coast is one long stretch of sand on which a heavy surf breaks.

- 35 About one mile eastward of Godawaye point the sandy beach advances slightly, and off this projection the reef is awash for a distance of nearly 2 cables offshore.

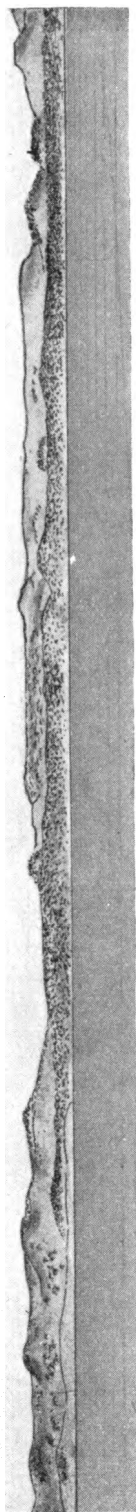
- Current.**—The currents, although weak, generally set parallel with the coast, and thus, being at right angles to the swell, prevent
40 a vessel from lying head on to the coast.

- During the survey the currents between Weligama and Hambantota were found to be weak, and, although sometimes variable in direction, they generally set with the prevailing wind; the greatest velocity registered was slightly less than one knot and the average
45 rate half a knot.

Chart 3730, plan of Hambantota.

- Hambantota.—Light.—Anchorage.**—Hambantota point is the south-eastern extremity of a rocky promontory with red sandy soil, from which a bare rocky ledge extends about three-quarters of a cable
50 south-eastward; the highest part of the ledge, which is at its outer end, is 14 feet (4^m3) high. A large white Martello tower and some houses stand on the promontory.

The town of Hambantota, which had a population of 3,133 in 1931, is situated about 3 cables west-north-westward of Hambantota point.

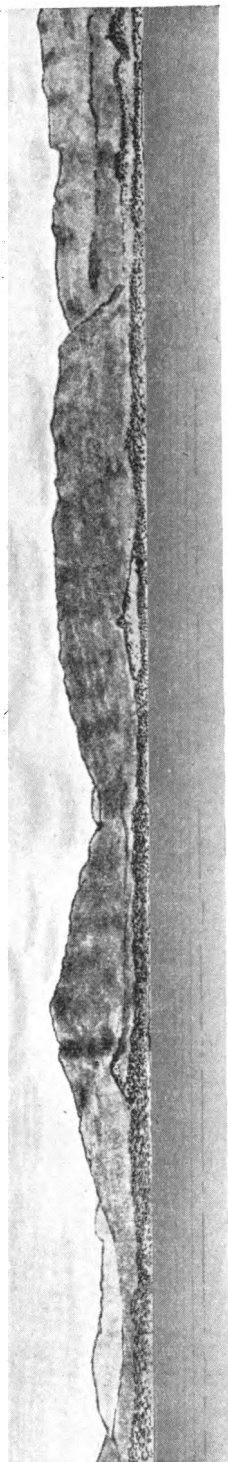


Walakanda (Waukagala).

a

a

b



Deniya kanda.

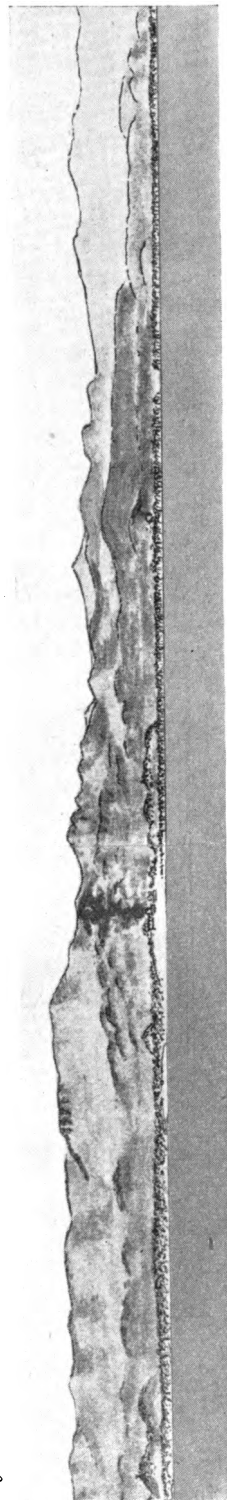
Kadurupokuna
(*Banyan tree*).

Ramale kanda.

a

b

b



Banyan tree.

Gongala, Tangalla point,
bearing 338°, distant 5½ m.

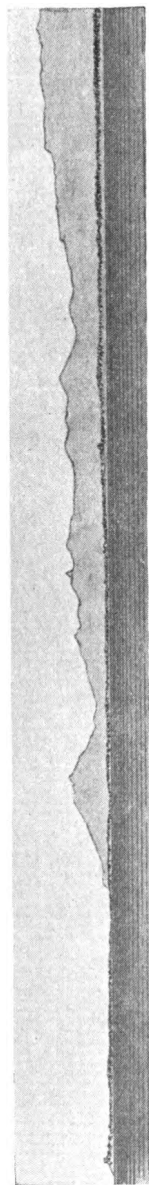
View, in three parts, of coast between Kolonna point and Tangalla.
(*Originals dated 1908.*)

b



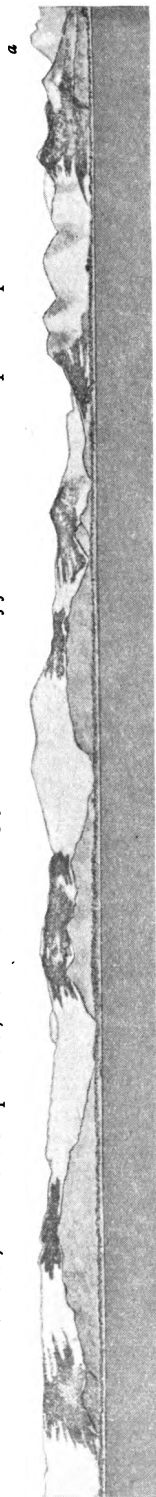
Deniya kanda. Ramale kanda.

Gongala.



^a Kirinde rock (Kirindi knob), bearing 290°, distant 7 miles.

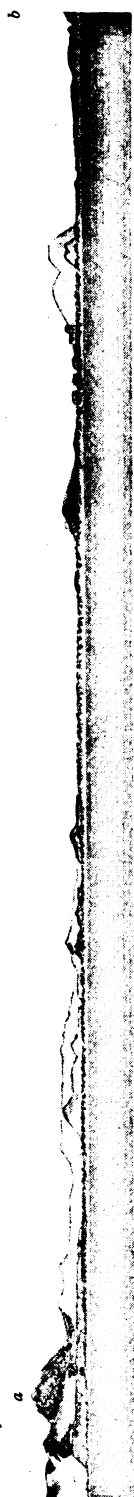
View, in two parts, of coast between Patirajja and Palatupana points.



Beraliyahela.

Binkemahela.

Kalaragana.



Modavchera.

Rocky knob, bearing 355°, distant 9 m.



Chimney hill.

Akasachetiya.

Demalagala.

View, in three parts, of coast between Palatupana and Butawa points. (Originals dated 1900.)

Chart 3730, plan of Hambantota.

An Assistant Government Agent, who is also the Master Attendant of the port, resides in the town.

A light is exhibited, at an elevation of 119 feet (36^m3) from a white tower, 47 feet (14^m3) in height, situated on the summit of the promontory, about 2 cables eastward of Hambantota point. 5

From a position on the northern side of the promontory, about 2 cables north-westward of Hambantota point, a sandy beach sweeps in a wide curve for about 1½ miles north-eastward to Pitawatan point, sandy, covered with scrub and terminating in a low rocky ledge. 10 There is seldom much protection from swell in the bay thus formed and even with north-westerly winds the swell sets fairly on to the coast so that a vessel at anchor has the swell on her port bow.

Anchorage may be obtained in depths of from 5 to 6 fathoms (9^m1 to 11^m0), sand, about 3½ cables north-eastward of the 14-foot (4^m3) rock south-eastward of Hambantota point; this is the best berth, 15 but during the north-east monsoon it is better to anchor farther south-eastward.

A pier projects northward from the southern end of the beach about three-quarters of a cable north-north-eastward of Hambantota light-house; the sea often breaks outside the pier and at such times, landing can be effected on the beach immediately northward of the pier. 20

Winds.—See Percentage frequency of wind direction at coast stations, page 87.

Chart 3265.

25

HAMBANTOTA TO KUMBUKKAN OYA ENTRANCE.

General directions.—Anchorage.—Between Hambantota and the mouth of Kumbukkan oya (aru) (Lat. 6° 30' N., Long. 81° 42' E.), about 42 miles north-eastward, the coast is sandy and barren with points from about 50 to 160 feet (15^m2 to 48^m8) high; between and behind these points the land is low, with here and there hills which usually rise abruptly, and in clear weather the mountain district of Ceylon will be seen in the background. 30

For vessels proceeding along the coast, the usual route and that recommended is outside the Great and Little Basses reefs, passing about 2 miles south-eastward of the lighthouses marking those reefs; care is necessary when passing the eastern end of Little Basses, where depths of less than 10 fathoms (18^m3) extend about 3 miles east-north-eastward of the lighthouse and vessels should not pass within this distance on that bearing from the lighthouse. 40

Open anchorage over a bottom of sand and rock may be obtained off almost any part of this stretch of coast, but none of the bights affords shelter during either monsoon, although during the South-west monsoon, if the wind is well westward, the sea is less disturbed off the eastern part of this stretch of coast. Close to the beach, on which the sea breaks heavily, there are several rocky patches, both sunken and above-water. 45

The most prominent landmarks, situated from 2 to 8 miles inland, are Kataragama peak, 1,395 feet (425^m2) high, which is the summit of a range sharp-topped when viewed from the south-westward, but flat-topped as seen from the south-eastward or eastward; it lies about 20 miles north-eastward of Hambantota. 50

Rocky knob, 322 feet (98^m1) high, which is a remarkable pillar

Charts 813, 828, 2898, 70.

Chart 3265.

of rock, amongst a rocky ridge, situated $6\frac{1}{2}$ miles south-eastward of Kataragama peak; Akasachetiya, 530 feet (161^m5) high, which is a very conspicuous mass of bare rock, situated about 4 miles north-eastward of Rocky knob; Mayagala, 725 feet (221^m0) high, which has a remarkable cone-shaped appearance when seen from eastward, Dematagala, which has two summits, the higher of which is 1,004 feet (306^m0) high, and Mandagala, the summit of which resembles a square tower, is 523 feet (159^m4) high (*see also page 134*); the three last-named hills lie from 13 to 5 miles westward of the mouth of Kumbukkan oya (*Lat. $6^{\circ} 30' N.$, Long. $81^{\circ} 42' E.$*). *See views facing pages 127 and 130.*

Currents.—Observations made between October, 1908, and May, 1909, tend to show that the currents in this locality are strongly influenced by the prevailing winds.

During October and the early part of November, the numbers of north-easterly and south-westerly currents with a maximum rate of one knot, were about equal, and from the latter part of November to March, they set with little variation between west-south-west and south-south-west, the maximum rate being 2 knots.

As an instance of the influence of the wind on the currents it may be mentioned that, after a cyclonic storm which occurred in the Bay of Bengal, in December, the north-easterly wind was replaced for a time by a light wind from south-westward, and the direction of the current was between north-north-east and east-north-east, until the change of wind ceased, when it resumed its old direction.

See also page 28.

Pitawatan point to Kirindi point.—**Coast.**—**Dangers.**—Between Pitawatan point and Gurugudu point, about $1\frac{1}{2}$ miles east-north-eastward, is a sandy beach with considerable sunken reef extending to a cable outside it. Gurugudu point (*Lat. $6^{\circ} 09' N.$, Long. $81^{\circ} 10' E.$*) is rounded, and not easily distinguishable as a point; a few detached rocks lie off it, close to the coast.

Patirajja point, about $3\frac{1}{2}$ miles farther east-north-eastward, is of a slightly reddish colour, and terminates in a rocky ledge 2 feet (0^m6) high. The coast between Gurugudu and Patirajja points is bordered by a sandy beach, with a bare sand hill, slightly higher than the elevated ground of the latter point, about 3 cables westward of it; westward of the same point is a small bight, the shore of which is covered with scrub.

For view of the coast between Patirajja point and Kirindi point, about $7\frac{1}{2}$ miles east-north-eastward, as seen from Great Basses ridge, *see the two top parts of the view facing page 127.*

From the small bight immediately northward of Patirajja point, the sandy beach is nearly straight to Urani point about $3\frac{1}{2}$ miles east-north-eastward; it may be identified by a small grove of coconut palms lying behind it, as such palms are of rare occurrence in this locality. Bundala village is situated near this grove. Dorava point, about 3 miles east-north-eastward of Urani point, is bare, rocky, and 58 feet (17^m7) high, and may easily be identified.

Lansiya rock, situated about half a mile southward of Dorava point, is 21 feet (6^m4) high; foul ground extends westward and north-westward from the rock for a distance of about one mile.

Dorava rock, a rocky head with a least depth of 3 fathoms (5^m5),

Charts 813, 828, 2898, 70.

Chart 3265.

lies about three-quarters of a mile south-south-eastward of Dorava point and is the outermost danger off that point.

Between Dorava point and Butawa point, a moderately high point about $11\frac{1}{2}$ miles north-eastward, sandhills and rocky formations of moderate height lie close behind the coastline. 5

Kirindi point is a rocky formation situated about $1\frac{1}{2}$ miles north-eastward of Dorava point. Kirinde rock (Kirindi knob) is a group of boulders, 123 feet (37^m5) high, about a quarter of a mile westward of the point; it may be seen from westward over the land inside Dorava point, appearing as a conical summit. 10

Kirinda (Kirindi) village, which lies close to the beach northward of the point, is a Government salt-collecting station; native sailing craft anchor close off the village; landing is generally difficult, but is usually possible during the South-west monsoon. 15

A rocky ledge extends east-south-eastward from Kirindi point, and outside it, at about $2\frac{3}{4}$ cables from the point, is Korha rock, which is 2 feet (0^m6) high.

A rock, with a least depth of $1\frac{1}{2}$ fathoms (2^m3), lies about $2\frac{1}{2}$ cables east-north-eastward, and a reef, about 2 cables in diameter, on which the sea always breaks, is situated about $4\frac{1}{2}$ cables north-eastward of the point; between the rock and the reef there is a channel about one cable wide, with depths of from 3 to 5 fathoms (5^m5 to 9^m1). 20

Anchorage.—Only the same open anchorage as on other parts of this coast can be obtained, but a vessel wishing to communicate with Kirinda village (*Lat.* $6^\circ 13' N.$, *Long.* $81^\circ 20' E.$) will find better anchorage southward, rather than eastward, of the point, in depths of from 8 to 10 fathoms (14^m6 to 18^m3), as there appears to be a considerable amount of rock eastward of Kirindi point. Approaching the anchorage, Kataragama peak should be kept well open eastward of Kirinde rock, bearing about 359° , which leads only just eastward of Dorava rock. 30

Kirindi point to Butawa point.—**Coast.**—Palatupana point is the extremity of a sandy elevation between $2\frac{1}{2}$ miles north-eastward of Kirindi point; a sandy bay lies between the two points and sunken patches of rock extend about a cable from the shore of the bay. 35

Mutugala point, which is somewhat similar to Palatupana point, lies about 2 miles north-eastward of it, with a sandy coast between. A bushy summit, 196 feet (59^m7) high, is situated about $1\frac{1}{2}$ miles north-westward of the point, and another, 129 feet (39^m3), about half a mile northward of the point; these two bushy summits are used as leading marks when passing inside Little Basses ridge, *see* page 133. 40

Mutugala point is fronted by patches of rocky reef, and about one cable south-eastward of it is a rock, 6 feet (1^m8) high; shoal patches, with a depth of $3\frac{3}{4}$ fathoms (6^m9) over the outer one, extend half a mile southward from the point. Amaduwa point, which is low and rocky at its extremity, lie about $2\frac{1}{2}$ miles north-eastward of Mutugala point; between the two points the coast is rocky and sandy, and a rocky reef, the outer part of which is awash, extends about 3 cables offshore midway between the points. Two rocks, 14 and 18 feet (4^m3 and 5^m5) high, lies southward of Amaduwa point, the outer and higher being at a distance of $1\frac{1}{2}$ cables. A rocky head, with a depth of 4 fathoms (7^m3), lies half a mile south-eastward of the point. 50

Landing may be effected in a small bight immediately northward

Chart 3265.

of Amaduwa point. It is the first convenient landing-place eastward of Hambantota.

The sandy coast between Amaduwa point and Butawa point, about 5 $3\frac{3}{4}$ miles east-north-eastward, forms several bights, and several rocks lie from one to 2 cables offshore, two of which, 12 and 15 feet (3^m7 and 4^m6) high, respectively, lie close together, $2\frac{1}{4}$ cables off. Shoal water, the outer part of which has a least depth of $2\frac{3}{4}$ fathoms (5^m0), extends for a distance of $4\frac{1}{2}$ cables from the coast about $1\frac{1}{2}$ miles north-eastward 10 of Amaduwa point. Butawa rock, which is 6 feet (1^m8) high, and steep-to on its south-western and south-eastern sides, lies about 2 cables south-eastward of Butawa point (*Lat. $6^{\circ} 18' N.$, Long. $81^{\circ} 29' E.$*). Chiddle rock, with a depth of $5\frac{1}{4}$ fathoms (9^m6), and steep-to, lies almost 6 cables south-eastward of Butawa rock. See view facing 15 this page.

Off-lying dangers.—Light.—Great Basses ridge is a narrow, rocky ridge with depths of less than 10 fathoms (18^m3), and steep-to, which extends about $13\frac{1}{2}$ miles in an east-north-easterly direction from a position about 3 miles southward of Urani point.

20 Great Basses reef lies on the ridge about 2 miles from its eastern end. Some parts of the reef are about a quarter of a mile in length above water, and the highest part, on which the lighthouse stands, is 6 feet (1^m8) high.

A light is exhibited, at an elevation of 110 feet (33^m5), from a 25 white granite tower, having a conically-shaped top, 125 feet (38^m1) in height, situated on the north-eastern and highest part of Great Basses reef.

The tower is surrounded by two galleries, one above the base and the other close under the lantern.

30 Except within 2 miles of the lighthouse, no depth of less than 7 fathoms (12^m3) has been found on Great Basses ridge, but vessels should not approach within that distance of the lighthouse, in either an east-north-easterly or a west-south-westerly direction.

Ship rock, with a depth of 5 fathoms (9^m1) over it, lies in the 35 middle of a narrow, rocky shoal, on which the depths are less than 10 fathoms (18^m3), about $5\frac{1}{2}$ miles north-eastward of Great Basses reef lighthouse.

Butawa point to Illukatiya point.—Coast.—Dangers.—Shoal and uneven depths extend to a distance of about 7 cables from the 40 rocky and sandy coast between Butawa point and Patanagala point, about 2 miles north-eastward; the outermost danger is a rock, with a least depth of $3\frac{3}{4}$ fathoms (6^m9) over it, situated about three-quarters of a mile south-south-eastward of Patanagala point.

Patanagala point is the extremity of a bare rocky hill, somewhat 45 resembling a haystack and 137 feet (41^m8) high. Elephant rock, 2 feet (0^m6) high, lies about 4 cables east-south-eastward of Patanagala point.

Transit hill, a bare, rocky elevation having two summits of nearly equal height and joined by a ridge of only slightly less elevation, is 50 situated about 4 cables west-north-westward of Patanagala point; the western summit is 163 point (49^m7) high.

Some rocky ledges form a slight breakwater northward of Patanagala point, and between them and the coast landing is sometimes practicable.



Korunagala.

Akasachetiya.



Mayagala. Butawa point.

Transit hill of Demagala, bearing 01°.

Patanagala point.

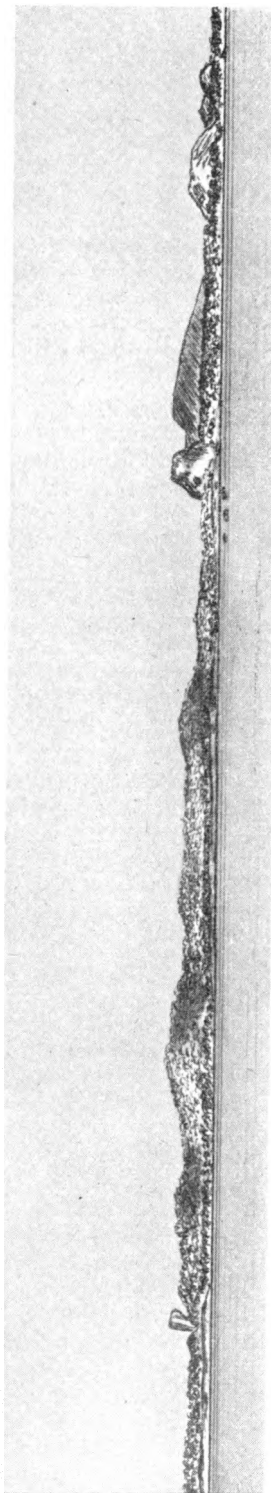
View, in two parts, of leading marks for western entrance to passage inside Little Basses reef.



Butawa rock of Bush summit, bearing 241°.

Butawa point.

Vilapanauwagala.

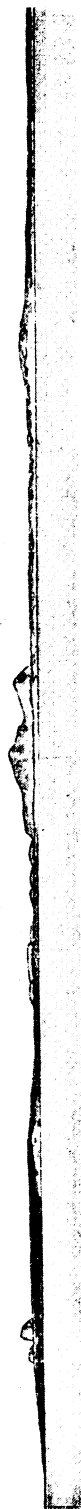


Rocky knob.

Patanagala point.

View, in two parts, of leading marks for the passage inside Little Basses reef. (Originals dated 1908.)

a



Akasachetiya.

Kalaragama, bearing 262°.

a



Mayagala.

Dematagala.

Mandagala,

bearing 292°, distant about 9½ m.

View, in two parts, of coast between Pillinawa and Illukatiya points.

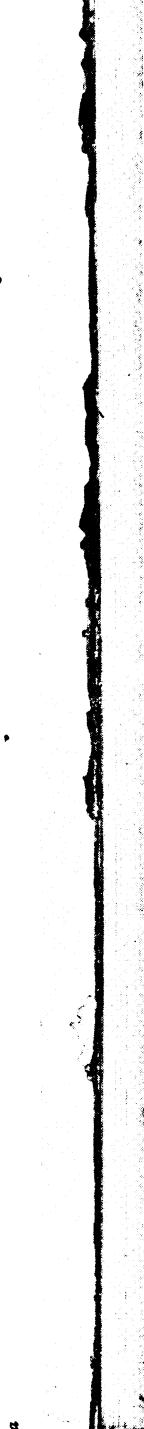
a



Kongala.

Yakkala,
bearing 334°.

a



Umbrella rock.
Westminster Abbey.

Asses' Ears,
bearing 345°.

Dunlop hill.

Kudambegala.

View, in two parts, of coast between Illukatiya and Chen points.

(Originals dated 1906.)

Chart 3265.

A sandhill, 108 feet (32^m9) high, situated about 4½ miles north-eastward of Patanagala point, terminates in two rocky points about three-quarters of a mile apart, the north-eastern of which is Pillinawa point; being backed by low land, it appears from a distance as an island. Two rocky heads, one foot (0^m3) high, extend about 3 cables southward of the south-western of these two rocky points. Shoal water extends half a mile offshore outside these heads. In the bay between Patanagala and Pillinawa points the coast is closely backed by sandhills, and off the beach there are patches of reef, on which the sea breaks heavily. For the aspect of the coast between Pillinawa and Illukatiya points, *see* view facing this page.

Menik ganga, also known as Yala river, flows into the sea about midway between Patanagala point and Pillinawa point.

For a distance of about 2 miles westward of Pillinawa point the coast should not be approached within three-quarters of a mile.

From about one mile north-eastward of Pillinawa point, to Uda point, a distance of about 3½ miles, the coast is closely backed by sandhills of moderate height, partly covered with scrub. During the survey, in the months of March and April, 1909, landing was found practicable in a small bight northward of Uda point.

Rocks and sunken patches extend about one cable offshore between Pillinawa and Uda points; outside this the depths increase gradually to near the edge of Little Basses ridge.

Pahala point, about 3½ miles north-eastward of Uda point, is the extremity of a sandhill slope, and, for about one mile on either side of it, rocky ledges and sunken patches extend for a distance of about 1½ cables offshore. Illukatiya point, the southern entrance point of Kumbukkan oya, about 4 miles north-eastward of Pahala point (*Lat.* 6° 27' N., *Long.* 81° 40' E.), is ill-defined; between these two points the coast is principally composed of sandhills partly covered with scrub. Kumbukkan oya forms the eastern boundary of the Southern province; the area enclosed between this river and Menik ganga, and from the coast to the northern boundary of the Southern province, is preserved as a game sanctuary.

The mouth of Kumbukkan oya is fronted by patches of sunken reef which extend about 2 cables offshore.

Off-lying dangers.—Light.—The south-western end of Little Basses ridge lies about 9 cables south-eastward of Butawa point, thence it runs in an east-north-easterly direction for about 17 miles with depths of not more than 5 fathoms (9^m1); the ridge is in most parts very narrow and steep-to.

For the first 4 miles there are many rocky heads, with depths of from 1½ to 3 fathoms (2^m7 to 5^m5) over them and on which the sea often breaks. Farther eastward the patches are less frequent, with depths of from 3 to 4 fathoms (5^m5 to 7^m3) for about 10 miles; the ridge then broadens and about 1½ miles farther eastward is Little Basses reef, which is remarked on below. Southward of the western half of the Little Basses ridge is an extensive bank, with depths of from 5½ to 10 fathoms (10^m1 to 18^m3), sand, and depths of from 10 to 15 fathoms (18^m3 to 27^m4) between it and the ridge. The least depth found on any part of this bank is 5½ fathoms (10^m1), situated about 3¾ miles south-eastward of Pillinawa point.

Little Basses reef, about 2 feet (0^m6) high, lies about 1½ miles

Chart 3265.

within the north-eastern end of Little Basses ridge ; on its southern and south-eastern sides the approach is steep.

A light is exhibited, at an elevation of 110 feet (33^m5), from a white granite tower painted with a black band, 125 feet (38^m1) in height, on Little Basses reef. The light tower has a domed roof and is surrounded by two galleries under the lantern.

An area of shoal ground exists north-north-westward of the lighthouse, and no vessel should approach within a distance of 1½ miles of the reef, with the lighthouse bearing between 148° and 185°, as inside this distance the depths are irregular, and are not more than 3 fathoms (5^m5) in places. If wishing to communicate with the lighthouse, it should only be approached between the bearings of 134° and 109°, and near approach to the reef must be avoided on all other bearings.

Eastward of Little Basses reef the ridge, again quite narrow, extends for about 1½ miles from the lighthouse, beyond which the depths are irregular and overfalls occur. The sea may break on any part of Little Basses ridge with a moderate swell, where the depths are not more than 3 fathoms (5^m5), and it is probable it may break in a greater depth. It is not advisable for any vessel, except those of light draught, to attempt to cross any part of the ridge ; a light-draught vessel crossing the ridge for any purpose should do so between 2 and 6 miles south-westward of the lighthouse.

Atlas rock (*Lat.* 6° 25' N., *Long.* 81° 45' E.), with a depth of 3 fathoms (5^m5) over it, lies about 1½ miles north-eastward of Little Basses lighthouse.

Lewin rock, with a least depth of 3 fathoms (5^m5), lies about one mile from the coast about midway between Pahala and Illukatiya points.

Dædalus rock, with a least depth of 1½ fathoms (3^m2), lies about three-quarters of a mile south-south-eastward of Lewin rock. It appears to be a boulder resting on a narrow rocky ledge, with depths of from 3 to 5 fathoms (5^m5 to 9^m1), which extends about half a mile southward.

Inner passage.—Directions.—Although, as already stated (page 127), the general route for vessels is outside the Great and Little Basses reefs, in clear weather, with the natural landmarks visible, a light-draught vessel would probably find less sea by passing between the island and these reefs, in which case the following directions will be found useful :—

The exact points along the coast are not easily made out, but the following natural objects, useful for fixing a vessel's position, will be found easy of identification after reference to the chart and to the views facing pages 127 and 130 ; Rocky knob (page 127), Patanagala point, Akasachetiya, Mayagala Dematagala, Mandagala, and a summit, 293 feet (89^m3) high, close north-westward of Kongala (chart 813), situated about 4 miles northward of Illukatiya point.

Approaching from westward, vessels should steer 054°, passing about 1½ miles from Dorava point, and should continue this course until Transit hill is in line with Dematagala, bearing 011° (see upper view facing page 130) ; then keep these marks on, passing close westward of Chiddle rock, after passing which, Dematagala should be gradually opened eastward of Transit hill and course altered to 061°.

Chart 3265.

bringing Butawa rock in line astern, with the bush summit, 129 feet (39^m3) high, lying northward of Mutugala point, bearing 241°, *see* lower view facing page 130. Vessels should keep these stern marks in line, passing about three-quarters of a mile and 1½ miles, respectively, from Pillinawa and Uda points, and when Pahala point is nearly in line with Mandagala, bearing 330°, and about 2½ miles from the former, course should be shaped about 051°, passing about one mile south-eastward of Dædalus rock (*Lat.* 6° 27' N., *Long.* 81° 42' E.).

Winds.—*See* Percentage frequency of wind direction at coast 10 stations, page 87.

Currents.—The following observations of the current in the vicinity of Little Basses reef were made onboard the light-vessel, formerly in this position, in 1869.

In January, the current set south-south-west, at a rate of from 15 2 to 2½ knots; in February, south-south-west, 2 knots, but at times slackened; in March, generally south-south-west, but variable at times, and weak; in April, variable but occasionally south-west, usually weak, but strong if setting south-west; in May, north-east, from one to 3 knots; in June, July, August and September, north- 20 north-east, from one to 3 knots; in October, north-north-east, changing about the middle of the month to south-south-west, 5 knots; in November, south-south-west, from 4 to 5 knots; in December, south-south-west, 5 knots.

During the South-west monsoon, the current after setting north- 25 eastward at a rate of 3 knots for a period of about ten days, suddenly slackens, and sets south-westward at a rate of from 2 to 3½ knots for sometimes one day, at others a week.

In January the sea is cross and rough; vessels bound north-eastward should avoid the south-east coast of Ceylon. In March, the 30 passage up and down the coast is easy. In December, it is difficult for a sailing vessel to proceed northward along the south-east coast.

*Charts 813, 2031.***KUMBUKKAN OYA ENTRANCE TO FOUL POINT.—**

Currents.—The currents off the eastern coast of Ceylon are variable. 35 During the period January to April, they are likely to set onshore between the latitudes of 6° 30' N. and 8° 00' N.

In November and December, 1944, under normal weather conditions, southerly sets of 5 knots were experienced eastward of the 100-fathom (182^m9) line. 40

Between Little Basses reef and Trincomalee bay, about 130 miles northward, the direction of the inshore currents often changes during the period March to August, from north-going to south-going and back again without any apparent reason, but the direction is usually parallel with the coast. The north-going and south-going currents 45 often run side by side, more than one current in each direction having been found between 3 and 10 miles off the coast.

During an examination of Egeria patch, about 35 miles north-north-eastward of Little Basses lighthouse, in the South-west monsoon period of 1908, the current was found to set southward at the rate of 1½ knots. 50

In the vicinity of Komari (Komariya) ridge, about 4 miles northward of Egeria patch, the currents are reported to be variable and frequently to set towards the coast.

Charts 828, 70.

Charts 813, 2031.

Great care is therefore necessary when navigating between Little Basses reef and Trincomalee, but the taking of continuous soundings should give warning of any approach to danger.

*5 Chart 813.***Kumbukkan oya entrance to Sangama Kanda point.—Coast.**

—**Aspect.**—Between the mouth of Kumbukkan oya and Sangama Kanda point, about 33 miles north-north-eastward, the coast is nearly all sandy and is backed by jungle which extends over low, flat, and wooded ground to isolated hills at a considerable distance inland.

Mandagala, about 5 miles westward of Illukatiya point, is 523 feet (159^m₄) high, and conspicuous, its summit having a precipice of light-coloured rock facing northward. From south-eastward the top of the precipice appears clear of the summit of the hill. From the vicinity of Great Basses the hill is not well seen, and it is sometimes obscured by haze, especially during the South-west monsoon.

Chimney hill, about 11 miles north-westward of Mandagala (*Lat.* 6° 30' N., *Long.* 81° 37' E.), is remarkable, appearing as a truncated cone surmounted by a vertical rock, resembling a chimney; this hill, which is isolated and prominent, may be seen outside a distance of about 4 miles off the coast, when it shows above the low intervening land. Nearer to the coast is Kongala (page 132).

Asses' Ears, 5 miles farther northward, are easily identified, as is also Kudumbegala, 372 feet (113^m₄) high, about 2½ miles northward of Asses' Ears. *See view facing page 131.*

Coast.—Light.—Yakkala (Yakala) is a small village standing a short distance inland, but not visible from seaward, about 2½ miles north-north-eastward of Illukatiya point; its locality may be identified by a small grassy hillock on the beach close by.

Between Yakkala and a position on the coast south-eastward of Kudumbegala, about 7½ miles north-north-eastward, foul ground extends as much as three-quarters of a mile offshore. Marescaux and Monro rocks lie about half a mile offshore, about 1½ and 6 miles, respectively, north-north-eastward of Yakkala. Chen point lies about midway between these rocks. White Sand hill, about 7½ miles north-north-eastward of Chen point, and Split rock, about one mile farther north-north-eastward, are conspicuous. Panawa, about 2¼ miles north-north-eastward of Split rock, is a sandy ridge, covered with jungle, which terminates in a rocky point, covered with scrub, 85 feet (25^m₉) high; when seen from northward or southward it appears as a flat-topped islet. Southward of the point there is a considerable amount of bare sand. Bolt point, nearly 3 miles northward of Panawa, is a rock, 92 feet (28^m₀) high, and covered with scrub.

Arugam bay, entered about 2¼ miles north-north-eastward of Bolt point, affords good landing in its southern corner. A river flows into the bay, but during the survey, from March to August, 1887, its mouth was completely closed by a bar of sand. Nilagalahela is an isolated hill, 655 feet (199^m₆) high, situated about 8 miles westward of Arugam bay; it has two summits, the north-eastern being a little higher than the other. From eastward the hill appears as a single peak, steep on the southern side; being the highest hill in the vicinity, and darker in colour than the surrounding country, it is a good landmark.

Patten rock and Davidson rock, each awash, lie close offshore about

Chart 813.

5 and $7\frac{1}{2}$ miles, respectively, north-north-eastward of Bolt point. Sangama kanda, 283 feet (86^m3) high, lies about $2\frac{1}{4}$ miles inland and 12 miles northward of Bolt point. In this vicinity the land becomes higher than it is southward, with numerous hills, covered with scrub, 5 between 200 and 280 feet (61^m0 and 85^m3) high, but having no well-defined summits. Close southward of the parallel of Sangama kanda there is a long sandy patch on the coastline, which, with the higher land mentioned above, marks the vicinity of Komari (Komariya) village, which is not visible from seaward, and of Komari (Komariya) 10 ridge, *see* below. Sangama Kanda point lies about 3 miles east-north-eastward of Sangama kanda. A white martello tower, about 20 feet (6^m1) in height and surmounted by a grey topmark, stands near the point; its charted position is approximate only.

A light is exhibited, at an elevation of 25 feet (7^m6), from a white 15 concrete hut on Sangama Kanda point.

Off-lying depths and dangers.—The depths off the coast between Illukatiya point and Sangama Kanda point are fairly regular, gradually decreasing towards the land except northward of Arugam bay. 20

Egeria patch is a narrow ridge with depths of from 7 to 9 fathoms (12^m8 to 16^m5); its north-eastern extremity is situated about 5 miles from the coast eastward of Komari village. The bottom, composed of coral and sand, has been clearly seen in a depth of 9 fathoms (16^m5). 25

Komari ridge is composed of sand and coral and has a least depth 25 of $2\frac{1}{4}$ fathoms (5^m0); its northern extremity about $1\frac{1}{2}$ miles eastward of Sangama Kanda point (*Lat.* $7^\circ 02' N.$, *Long.* $81^\circ 52' E.$). Seaward of Komari ridge, and to a distance of 4 miles offshore, the bottom is very uneven; owing to this, heavy breakers may be caused by winds and currents. 30

Charts 813, 2031.

Sangama Kanda point to Batticaloa roads.—Aspect.—Danger.

—Between Sangama Kanda point and Batticaloa roads, about 45 miles northward, the land near the coast is low and flat and is cultivated in many places with coconut palms. The wreck of s.s. *Maimyo*, with 35 masts, funnel and upper works showing, was in 1938, situated close inshore about $3\frac{1}{2}$ miles northward of Sangama Kanda point.

From this vicinity, Wadinagala peak, about 22 miles west-north-westward of Sangama Kanda point; Konduruhela (Kumburahela), an isolated sugar-loaf peak, about 12 miles westward, and Westminster 40 Abbey, about 19 miles westward, of the same point, are all very prominent. Friar's Hood, about 22 miles northward of Wadinagala peak, shows up well while the Pambuthai Malai range lies between them. In clear weather, the more distant mountains are visible from off the coast and among these are Maragal kanda, a long and rounded moun- 45 tain, about 31 miles west-south-westward of Sangama Kanda point and Namunakuli, a sharp peak, 6,680 feet (2036^m1) high, about 45 miles westward of the same point. *See* view facing page 131, and on chart 813.

Westminster Abbey is a remarkable mountain, its north-western 50 end, 1,830 feet (557^m7) high, resembling a tower; the mountain is best seen from a position northward of Komari village but it is also prominent from southward. Wadinagala shows up well from all directions seaward; its precipitous summit forms a sharp peak, 2,413 feet (735^m5) high. 55

Charts 828, 70.

Charts 813, 2031.

The lower hills which form landmarks are :—Thomson hill, a wooded hill about 7 miles inland and about $9\frac{1}{2}$ miles north-westward of Sangama Kanda point ; Sharp hill, about $1\frac{3}{4}$ miles northward of Thomson hill, and Bennington hill, wooded and wedge-shaped, about $5\frac{1}{2}$ miles north-westward of Sharp hill. Friar's Hood is well named, and although there are hills around it, is unmistakable and readily identified from long distances in clear weather ; it is usually the first prominent landmark made when coming from northward. See views on chart 813 and facing this page.

The depths off this stretch of coast are regular with the exception of a few rocky patches within one mile of the coast. The 100-fathom (182^m9) contour line lies between 5 and 10 miles offshore and outside this line the depths increase suddenly and heavy overfalls occur even in the finest weather.

A cluster of red roofs about 10 miles northward of Sangama Kanda point, and a white tower, about 22 miles northward of the same point, are conspicuous.

Chart 2031.

Alphée shoal, with a least depth of $3\frac{1}{2}$ fathoms (5^m9) over it, lies about 2 miles east-north-eastward of the conspicuous white tower and about $1\frac{1}{2}$ miles offshore.

From a position abreast Alphée shoal, the coast trends north-north-westward for about 22 miles to the entrance to Batticaloa lake.

Chart 2031, with plan of Batticaloa roads.

Batticaloa roads.—Light.—Dangers.—Batticaloa roads, situated off the entrance to Batticaloa lake, afford good anchorage during the South-west monsoon but are dangerous during the North-east monsoon.

A light is exhibited, at an elevation of 88 feet (26^m8), from a white tower, 93 feet (28^m3) in height, situated on the western side of the entrance to Batticaloa lake. A white obelisk, 25 feet (7^m6) high, stands about one cable within the beach about $6\frac{1}{2}$ cables west-north-westward, and a conspicuous framework tower stands about $1\frac{1}{2}$ miles south-south-eastward, of the lighthouse.

Beacon rock, the outermost danger in the roads, with a least depth of $1\frac{1}{2}$ fathoms (2^m7) over it, lies about $1\frac{1}{2}$ miles east-north-eastward of Batticaloa lighthouse.

Brennus shoal, with a least depth of $1\frac{1}{2}$ fathoms (3^m2) over it, lies about one mile north-eastward of Batticaloa lighthouse ; a 3-fathom (5^m5) patch lies about 3 cables north-north-westward of Brennus shoal. Tower rock, with a least depth of one fathom (1^m8) over it, lies about one cable south-south-eastward of Brennus shoal.

In addition to the above-mentioned dangers there are numerous unnamed shoals lying between Beacon rock and Batticaloa lighthouse, the positions of which can best be seen on the chart.

Surveyor rock, with a least depth of $3\frac{1}{2}$ fathoms (6^m4) over it, lies about 8 cables north-eastward of the obelisk. Khandalla bank, with a least depth of $3\frac{1}{2}$ fathoms (6^m4) over it, lies about a cable south-westward of Surveyor rock.

Anchorages.—Directions.—A good berth for a large vessel is in a depth of $7\frac{1}{2}$ fathoms (13^m7), with the lighthouse bearing 151° , and the obelisk, 190° ; the vessel should approach the anchorage on the latter bearing.

A small vessel may anchor about $1\frac{1}{2}$ cables east-south-eastward

Charts 828, 70.



*Low land just
cropping up*

*Gap, bearing
239°*

*Friar's Hood,
bearing 203°*

Friar's Hood from east-south-eastward, distant about
33 miles.

(Original dated prior to 1883.)

Chart 2031, with plan of Batticaloa roads.

of Khandalla bank, in a depth of $6\frac{1}{2}$ fathoms (11^m9), with the lighthouse (*Lat.* $7^\circ 45' N.$, *Long.* $81^\circ 41' E.$) bearing 176° . This is a convenient berth for communicating with the shore.

Approaching from southward, a vessel should not get into depths of less than 10 fathoms (18^m3) until the obelisk bears 227° ; or, at night, until the light bears 199° . A light-draught vessel may approach this anchorage on the bearing of the obelisk.

Batticaloa lake.—From its entrance about 2 cables north-eastward of Batticaloa lighthouse, Batticaloa lake extends south-south-eastward for a distance of about 22 miles, its eastern shore being generally about $1\frac{1}{2}$ miles inside the coast. The entrance is fronted by a bar on which there are depths of from 3 to 6 feet (0^m9 to 1^m8), but its formation changes with each monsoon; it may be crossed without much difficulty during the South-west monsoon, but during the North-east monsoon, the entrance is almost inaccessible.

A railway bridge crosses the lake about 3 miles above the entrance; this bridge is passable by small vessels up to about 30 tons, with their masts down.

Chart 2031.

Town.—The town of Batticaloa, the headquarters of the Civil administration of the Eastern province, is situated about 3 miles within the entrance of the lake. The Government Agent is Master Attendant.

The population, in 1931, was 11,585.

Fresh provisions are very scarce.

There is a jetty, equipped with two cranes, situated at the fort. Small vessels load and discharge cargo alongside.

Life-saving.—A Power lifeboat is maintained.

Winds.—*See* Local winds.—East coast of Ceylon (page 59) and Percentage frequency of wind direction at coast stations, page 88.

At Batticaloa, during the night and morning, the wind is usually light and variable, particularly during the South-west monsoon, and in the transition periods between the monsoons. In the afternoons, sea breezes, usually from directions between north-east and south-east, are prevalent.

During the South-west monsoon, a hot dry Föhn wind, known locally as the Batticaloa Kachchān, and usually west or south-west at Batticaloa, may blow down from the hills. This is most prevalent during June and July, when west or south-west winds are recorded in the afternoon, instead of the usual easterly sea breeze, on an average about seven days a month. While this wind is blowing the air temperature may reach over 95° , while the relative humidity may fall to very low levels.

At the close of the South-west monsoon, Batticaloa is likely to be affected by depressions from the Bay of Bengal, while the North-east monsoon sets in about the end of November.

Batticaloa roads to Foul point.—Aspect.—Between Batticaloa lighthouse and Elephant (Clarke) point (*Lat.* $8^\circ 00' N.$, *Long.* $81^\circ 33' E.$), about 16 miles north-north-westward, there are numerous coconut trees on the coast and several distinctive hills in the background, but thence to Foul point, about 35 miles farther north-north-westward, the coast is low and covered with jungle and the hills inland are few and unimportant.

Chart 2031.

Tower hill, a hog-backed hill, 800 feet (243^m8) high, with a prominent rock resembling a tower on its summit, is situated about 17 miles westward of Batticaloa lighthouse.

- 5 Barons Cap, 691 feet (210^m6) high, is situated about 7 miles northward of Tower hill; from southward and eastward it has the appearance of a sugar-loaf, and, when clear of other hills, is prominent, especially when bearing about 280°; from the north-eastward its top appears broader and becomes merged into the hills farther southward. Gunners Quoin is a large wedge-shaped mountain, lying about 15 miles westward of Barons Cap, and is a good mark. See view B on chart 2031.

- Kirimechiodai malai (*Lat.* 8° 00' N., *Long.* 81° 25' E.), about 7 miles westward of Elephant point, is 185 feet (56^m4) high, but is only 15 seen when bearing between 247° and 292°; between these bearings it appears as a low, wedge-shaped hill with a little peak, rising steeply from southward and sloping northward. Kunchan kallú, 3½ miles farther westward, is 410 feet (125^m0) high; from south-eastward it appears wedge-shaped and moderately steep southward; from north- 20 eastward it has no well-defined summit. Small Quoin, 4½ miles west-north-westward of Kunchan kallú, is 518 feet (157^m9) high and from south-eastward slopes to a small rounded summit. See view B on chart 2031.

- Off-shore depths.**—Outside the 100-fathom (182^m9) contour line, 25 which passes at a distance of from 5 to 12 miles off the coast between Batticaloa roads and Foul point, the depths increase suddenly, and heavy overfalls occasionally occur, even in the finest weather.

- In thick weather, vessels may navigate safely off this stretch of coast by keeping in depths of not less than 20 fathoms (36^m6) by continuous 30 sounding, which depths are found at distances of from 2 to 7 miles offshore.

- Batticaloa lighthouse to Elephant point.—Coast.—Dangers.**—From Batticaloa lighthouse the coast trends north-westward for about 6 miles to Puna Kuda point from which a reef extends north-eastward 35 for about half a mile. Between Puna Kuda point and Vandeloos point, about 6 miles north-north-westward, the coast curves forming Kalkuda bay which is encumbered by several sunken rocks. Reefs, on which are Baker rocks, extend about 1½ miles north-eastward and about a quarter of a mile in other directions, from Vandeloos point. 40 A 1½-fathom (3^m2) rocky patch lies about one mile southward of Vandeloos point and another rocky patch with a similar depth over it, lies about 1½ miles south-eastward of the point. A small pier on which is a crane, is situated in the north-western corner of Kalkuda bay but in 1940, it was reported to be unsafe. 45 Vandeloos bay is entered between Vandeloos point and Elephant point, about 4½ miles north-north-westward. Elephant point is low and fringed by rocks and foul ground, and foul ground also extends about one mile off the shores of the bay. Valaichchenai river flows into the head of the bay. Elephant rock, 23 feet (7^m0) high, and 50 light-coloured, lies close northward of Elephant point.

Elephant point to Kadeawella point. — Off-lying bank. — Foul ground.—Obstruction.—From Elephant point, the coast trends north-north-westward for about 15 miles to Kadeawella point. Challitivu (Chelitivo) islet, about 30 feet (9^m1) high and wooded, lies

Chart 2031.

about 9 miles north-north-westward of Elephant point and about half a mile offshore. Panditivo point, sharp and rocky, with a small above-water rock lying close off it, is situated about $4\frac{1}{2}$ miles north-north-westward of Challitivu islet and about $1\frac{3}{4}$ miles farther north-north-westward is Kadeawella point, which is fronted by several rocks, the highest being 10 feet (3^m0) high. 5

A bank with a depth of 16 fathoms (29^m3) over it, which in 1948 had not been examined, lies about $10\frac{1}{2}$ miles eastward of Panditivo point.

Foul ground, due to dumped mines and indicated on the chart by 10 a pecked line, exists between positions about $2\frac{3}{4}$ miles east-north-eastward of Challitivu islet and $1\frac{1}{4}$ miles east-north-eastward of Panditivo point (*Lat.* $8^{\circ} 11' N.$, *Long.* $81^{\circ} 26' E.$).

A submerged obstruction, the position of which is approximate, lies about $4\frac{1}{2}$ miles north-eastward of Kadeawella point and about the 15 same distance offshore.

Submarine exercise area.—An area in which submarines exercising may be met with, extends for a distance of from 35 to 50 miles eastward of the coast between Kadeawella point and a position about $6\frac{1}{2}$ miles north-westward of Ava point, *see* page 156. The area, which 20 is indicated on the chart by pecked lines, is bounded eastward by the meridian of *Long.* $82^{\circ} 00' E.$

Kadeawella point to Foul point.—Rocks and dangers.—From Kadeawella point, the coast trends north-north-westward for about 18 miles to Coral point. Virgel rocks, two sunken rocks and a rock 25 3 feet (0^m9) high, lie about $2\frac{1}{2}$ miles northward of Kadeawella point and about one mile offshore. Tree rock, 43 feet (13^m1) high, with a tree on it, lies about 5 miles north-north-westward of Kadeawella point and about 3 cables offshore; a rock, 2 feet (0^m6) high, lies about half a mile eastward of Tree rock. 30

There is a conspicuous patch of rock on the coast about $1\frac{1}{2}$ miles north-north-westward of Tree rock. Alligator rock, 3 feet (0^m9) high, lies about $1\frac{1}{2}$ miles east-north-eastward of the patch of rock, and between them is Ship rock, 62 feet (18^m9) high. A sunken rock lies close north-eastward of Alligator rock. The entrance to Ullackalie 35 lagoon (Ilantottunu river) lies about $2\frac{3}{4}$ miles northward of the conspicuous patch of rock; several islets lie off the river mouth, the highest being 60 feet (18^m3) high with some trees on it, and is prominent. White rock, 25 feet (7^m6) high, situated on the beach about 3 miles north-north-westward of the mouth of Ullackalie lagoon, shows up well 40 during the forenoon.

Chart 815.

Heming rocks extend about $1\frac{1}{2}$ miles north-eastward from White rock; the highest of the group is 20 feet (6^m1) high and the outermost rock is 7 feet (2^m1) high and lies about one mile offshore. A rock, 45 awash, lies about 2 cables south-south-eastward of the 7-foot (2^m1) rock.

From White rock, the coast continues in a north-north-westerly direction for about 5 miles to Brown Rock point; inside the 3-fathom (5^m5) line, which here passes from 2 to 3 cables offshore, there are 50 several rocks with depths of less than 6 feet (1^m8) over them. A shoal with a depth of 33 feet (10^m1) over it, lies about $8\frac{1}{2}$ cables east-south-eastward of Brown Rock point, and shoals with lesser depths over them lie north-westward of this shoal.

Charts 2031, 828, 70.

Chart 815.

Coral point, about one mile northward of Brown Rock point, is surrounded by a coral reef, and between it and Foul point, about $2\frac{1}{2}$ miles north-westward, the coast is fringed by foul ground with numerous off-lying rocks extending for a distance of about 2 cables offshore; depths of 18 feet (5^m5) and less extend in places as much as 4 cables offshore along this stretch of coast. A shoal with a depth of 36 feet (11^m0) over it, lies about $1\frac{1}{4}$ miles eastward of Foul point.

Foul point.—Dangers.—Light.—Foul point, locally known as Kevuliya, forms the south-eastern entrance point of Trincomalee bay and is low and covered with coconut palms. A reef, with depths of 3 fathoms (5^m5) and less over it, extends about 7 cables north-north-westward from the point; a rock with a depth of 9 feet (2^m7) over it lies near the outer extremity of the reef. Munayai Paru, a coral patch with large boulders, with a least depth of 14 feet (4^m3) over it and steep-to, lies about one mile north-north-westward, and a shoal with a depth of 19 feet (5^m8) over it, lies about $8\frac{1}{2}$ cables northward, of Foul point.

A light is exhibited, at an elevation of 104 feet (31^m7), from a white cylindrical tower, 120 feet (36^m6) in height, situated near the extremity of Foul point (*Lat.* $8^\circ 32' N.$, *Long.* $81^\circ 19' E.$).

Chart 2031.

Current.—Near Trincomalee, between the months of October and February, there is usually a southerly current of from half a knot to 3 knots, and in March and April and again in August a northerly set of from half a knot to $1\frac{1}{4}$ knots occurs. In May, June, July, and in September the current is inappreciable, but irregular currents sometimes run strongly northward, and sometimes southward.

See also page 133.

30 Chart 815.

APPROACHES TO TRINCOMALEE HARBOUR.—General remarks.—Trincomalee harbour is approached through Trincomalee bay, the entrance to which lies between Foul point and Flagstaff point, about $5\frac{1}{2}$ miles north-westward; the entrance to the harbour lies on the north-western side of the bay, about 3 miles south-south-westward of Flagstaff point.

Koddiyar bay occupies the southern portion of Trincomalee bay and Tambalagam bay (Lake Tamblegam) extends west-north-westward from its north-western corner.

40 South-eastern side of Trincomalee bay.—Islands and dangers.—Between Foul point and Norway point, about $2\frac{1}{2}$ miles west-south-westward, the south-eastern shore of Trincomalee bay is low and fronted by a bank which, with depths of less than 3 fathoms (5^m5) over it, extends as much as half a mile offshore in places. The dangers northward and north-north-westward of Foul point are described above. Northesk rocks, a patch with a least depth of 4 feet (1^m2) over it, lies about $1\frac{1}{4}$ miles north-eastward of Norway point, and Norway islet, 44 feet (13^m4) high, lies about 4 cables west-south-westward of the same point.

50 Shoals, with depths of 34 and 32 feet (10^m4 and 9^m8) over them, lie, respectively, about 5 cables northward, and 6 cables north-westward, of Norway point; between these shoals and the point, there are depths of 18 feet (5^m5) and less and numerous off-lying rocks exist within a

Charts 2031, 828, 70.

Chart 815.

distance of 3 cables offshore. A shoal with a depth of 42 feet (12^m8) over it, lies about one mile north-westward of Norway point and an unnamed islet, 6 feet (1^m8) high, lies about 2 cables north-westward of the same point.

Beacon rock, 8 feet (2^m4) high, and situated about 6 cables west-south-westward of Norway point, bearing 220° and open north-westward of Norway islet, leads north-westward of Northesk rocks and Munayai Paru.

During the South-west monsoon there is good landing for boats in the north-eastern corner of Shell bay, situated about 6 cables south-westward of Foul point lighthouse, behind some detached rocks which, in 1929, were marked by two white beacons.

North-western side of Trincomalee bay.—Flagstaff point to Elephant point.—Islands and dangers.—Buoy.—Flagstaff point, the north-western entrance point of Trincomalee bay, is the northern extremity of Fort Frederick, locally known as Koddai; it is a bold promontory, bounded on its eastern side by black vertical cliffs, which gradually diminish in height from Flagstaff point, where they are 30 feet (9^m1) high, to the south-eastern corner, where they reach sea level in a rocky point. See view on chart 815.

The top of the headland slopes with the cliffs, thus presenting a wedge-shaped appearance to the whole promontory as seen from northward or southward. The summit, 1½ cables from its northern point, is 170 feet (51^m8) high, and on it is a building. A large detached rock, with perpendicular sides and a flat top, lies close off the northern end of Flagstaff point (*Lat.* 8° 35' N., *Long.* 81° 15' E.).

The maidan, an open grass space between the fort and the town, is the south-western termination of Fort Frederick, and here is a fortification wall, 50 feet (15^m2) high, with bastions at each angle and the remains of a moat; the white-painted gateway of the fort, on the southern face, is prominent from that side, but a sally port on the northern side, near the sea, is not so easily identified.

The Irrigation office, a large white building near the sea on the southern front, is very prominent from that direction, but other buildings in the fort, which include the old barracks and church, being mostly low and obscured by trees, are not readily distinguished.

Dutch bay is entered between the southern side of Fort Frederick and Dutch point, about 6½ cables southward. The shore of the bay is low and sandy, the flat land, on which the southern part of the town of Trincomalee is built, stretching back to Trincomalee harbour. Dutch point, 110 feet (35^m5) high to the tops of the trees, has a cliffy and rocky sea face. The residence of the Assistant Government Agent is amongst the trees on Dutch point, but it is partly obscured.

The conspicuous objects are the Government hospital, a long low building close to the Government Agent's house; the white dome of the Roman Catholic church, showing above the trees, about half a mile north-westward of Dutch point; and the Naval Commissioner's house (chart 816), which is flat-topped, painted white with two storeys and a pillared verandah, standing amongst the trees about half a cable within the beach, about three-quarters of a cable northward of the Roman Catholic church.

The northern part of Dutch bay, near Fort Frederick, is shoal and rocky, and there is a small rocky islet, named Pra Malai, about

Chart 815.

half a cable offshore, behind which is the best landing place when there is any swell.

Charts 815 and 816.

- 5 Rocky point, about 3 cables south-eastward of Dutch point, is the north-eastern termination of Ostenburg ridge. It is narrow and clifty, and extends about 3 cables north-eastward in a series of remarkable knife-edged rocks; amongst these rocks is a rocky pillar, 65 feet (19^m8) high, which is prominent from northward and southward.
- 10 The rocks, forming the point, gradually diminish in height, and the outer ones are only from 2 to 3 feet (0^m6 to 0^m9) high; they end in a shoal ridge about half a cable outside the outermost rock, where it is steep-to.

- Chapel point, about one mile southward of Rocky point, is rocky
- 15 with a rounded base, behind which the land rises steeply to Chapel hill. Two small coves, encumbered with rocks, are formed between the two points, being separated by a clifty point sloping from a hill, 150 feet (45^m7) high, situated in the valley between Ostenburg and Elephant ridges. Chapel hill, 338 feet (103^m0) high, forms the north-
- 20 eastern end of Elephant ridge; the hill is covered with jungle, but the remainder of the ridge is more sparsely wooded, and, in places, between the trees are long vertical streaks and spaces of red earth.

- Chapel island (*Lat.* 8° 33' N., *Long.* 81° 15' E.), lies about 1½ cables southward of Chapel point. The northern part of the island is flat,
- 25 with trees and bushes, but the higher portion is bare rock, the summit being a large square-topped and flat-fronted boulder. A chain of rocks, the highest about 4 feet (1^m2) high, extends about 1½ cables south-westward, and a similar chain, not so noticeable, projects about a quarter of a cable from its north-eastern extremity. The passage
- 30 inside the island, being shoal and foul, can only be used by quite small boats.

- Chapel rock, 3 feet (0^m9) high, lies about 4 cables north-eastward of Chapel point. A chain of detached rocky shoals, with depths of 1½ fathoms (2^m7), and with a rock awash at its outer end, extends about
- 35 1½ cables north-eastward from the rock; the depths then increase suddenly to 8 and 12 fathoms (14^m6 and 21^m9).

A detached rock off Flagstaff point, in line with Elizabeth point (page 155), bearing about 337°, leads eastward of Chapel rock and of the shoal water off Rocky point.

- 40 The coastline between Chapel point and Elephant point, about 1½ miles south-westward, is fronted by cliffs of no great height and with narrow sandy beaches strewn with boulders in places; towards Elephant point it becomes low. Elephant point may easily be identified by the low bastion of an old fort which stands on the extremity of
- 45 the small flat promontory forming the point which is a few feet high. Hood's tower stands near the summit of a hill 254 feet (77^m4) high, situated about 3½ cables north-eastward of Elephant point.

A narrow ledge terminating in a depth of 1½ fathoms (2^m3) extends about three-quarters of a cable south-westward from Elephant point.

- 50 Elephant island, about 3 cables south-eastward of Elephant point and separated from the point by Elephant pass, is 117 feet (35^m7) high to the tops of the trees with which it is covered on its eastern part, but its western part is a narrow rocky point which terminates in a small cone, 8 feet (2^m4) high, *see* view on chart 815.

Charts 2031, 828, 70.

Chart 816.

Foul ground extends for a distance of $2\frac{1}{2}$ cables in a north-easterly direction from the north-eastern point of Elephant island ; a detached rock, with a depth of less than 6 feet (1^m8) over it, lies northward of the foul ground, about $1\frac{1}{2}$ cables north-eastward of the point. 5

Elephant rock, with a least depth of 4 feet (1^m2) over it, lies over a cable westward of the south-western extremity of Elephant island ; it is marked by a red conical buoy moored nearly one cable south-eastward of the rock. Between the rock and Elephant island there are depths of less than 3 fathoms (5^m5) ; a depth of 3 fathoms (5^m5) 10 exists about half a cable south-eastward of the rock.

Elephant pass, the channel between Elephant island and the main island, has a least depth of $2\frac{1}{2}$ fathoms (4^m6) in the fairway, but, in 1947, its navigation was limited by an obstruction.

Clappenburg point to Marble point. — Beacons. — Dangers. — 15
Buoy.—Clappenburg point, about $8\frac{1}{2}$ cables west-south-westward of Elephant point, lies on the western side of the entrance to Trincomalee harbour. It is the eastern extremity of a remarkable narrow cockscomb ridge which forms a straight and bare cliff on its southern side and extends about half a mile west-south-westward from the point ; 20
 it has two summits, 100 and 97 feet (33^m5 and 29^m6) high, respectively, and small shrubs grow along the crest of the ridge. About $3\frac{1}{2}$ cables west-south-westward of Clappenburg point, the cliffs are broken to the waterline by a precipitous gap, about a quarter of a cable in width which is just covered at high water ; the part eastward of the gap is 25
 known as Clappenburg island.

A conspicuous masonry beacon, 10 feet (3^m0) in height, painted in black and white horizontal bands and surmounted by a small cage, stands on Clappenburg point.

Between Clappenburg point and Marble point (*Lat.* $8^\circ 31' N.$, 30
Long. $81^\circ 13' E.$), about $1\frac{1}{4}$ miles southward, the coast is indented by three small sandy bays, separated from each other by broad, rocky points with boulder-strewn shores. Near the northern part of the head of Deadman's cove, the northernmost of these bays, is a white mosque on a small hill which is moderately prominent when seen clear 35
 of trees ; Clappenburg hill, 362 feet (110^m3) high and covered in dense jungle, rises to a double summit named Kari malai Utu malai, about half a mile westward of the mosque.

Diamond point, about half a mile north-north-westward of Marble point, is the dividing point between Marble bay, the southernmost, and 40
 Sweat bay, the middle, of the three bays on this stretch of coast ; the point rises to Diamond hill, a wooded and fairly prominent summit, 258 feet (78^m6) high ; White Top rock, 22 feet (6^m7) high, lies close off Diamond point.

Marine pier, a wooden pier, 220 feet (67^m1) long and 12 feet (3^m7) 45
 wide, extends in an 074° direction from the south-western corner of Sweat bay.

Marble point is the western entrance point of Koddiiyar bay ; when seen from eastward, it appears as a small rounded hill, 99 feet (30^m2) high, terminating southward in a rocky ridge about 3 feet (0^m9) high, 50
 the hill being apparently connected with Diamond hill by a low, flat neck of land, *see* view on chart 815.

A white, conical concrete beacon, surmounted by a staff and triangle, point down, stands on Marble point but is not conspicuous. A rock

Chart 816.

with a depth of less than 6 feet (1^m8) over it, lies about half a cable southward of the beacon and a rocky patch with depths of less than 6 feet (1^m8) over it, is situated about one cable south-south-eastward of the beacon. A bank on which the depths are less than 6 fathoms (11^m0) surrounds the point, extending about 4 cables offshore north-eastward to south-eastward. If landing, care is necessary to avoid foul ground which extends about half a cable from the north-western and south-eastern sides of the point.

- 10 Nade Munai paar; a $1\frac{1}{4}$ -fathom (2^m3) patch, and Minden rock, with a least depth of 2 fathoms (3^m7) over it, lie about $2\frac{1}{2}$ and 3 cables, respectively, south-eastward of Clappenburg point; these two dangers are steep-to and are seldom marked by breakers or show in any way. Hatam Urita kallú (Kalle), with a least depth of 5 feet (1^m5) over it, 15 lies about $3\frac{1}{2}$ cables southward of Clappenburg point.

Grommet rock, awash, lies about $4\frac{1}{2}$ cables southward of Clappenburg point; the sea usually breaks on the rock during the South-west monsoon but it is often not visible on a calm day. An unnamed $1\frac{1}{4}$ -fathom (2^m3) patch lies about midway between Grommet rock and 20 Minden rock.

A spherical buoy, painted in red and white horizontal bands, is moored close north-eastward of Grommet rock.

Off-lying island. — Dangers. — Light. — Round island, locally known as Patalamalai, lies about 7 cables east-north-eastward of 25 Marble point; a rock 8 feet (2^m4) high lies close to the north-eastern extremity of the island and another rock, 5 feet (1^m5) high, lies close to its south-western extremity. An islet, 15 feet (4^m6) high, lies about half a cable south-westward of the island with a narrow boat passage between.

- 30 Foul ground, on which is a rock, awash and generally marked by breakers, extends about half a cable northward from the island. A spit with a depth of $2\frac{3}{4}$ fathoms (5^m0) over its extremity, extends about three-quarters of a cable north-north-westward of the north-eastern point of Round island, and a detached $3\frac{1}{4}$ fathoms (5^m9) patch 35 lies a similar distance west-north-westward of the north-western point of the island.

Landing can be effected on either the eastern, or the south-western, side of the island, according to the monsoon.

- A light is exhibited, at an elevation of 103 feet (31^m4), from a white 40 cylindrical tower, 69 feet (21^m0) in height, situated on the summit of Round island (Lat. $8^\circ 31' N.$, Long. $81^\circ 13' E.$).

Chart 815.

- Anchorage.**—During the height of the South-west monsoon Dutch bay will be found a more convenient anchorage for boat work than 45 Trincomalee harbour, as there is an excellent lee, good landing anywhere along the shore, and, as a rule, no swell; it is also nearer to the European part of the town.

The best anchorage in the bay is in a depth of $6\frac{1}{2}$ fathoms (11^m9), sand, with the hospital, bearing 231° , the dome of the Roman Catholic 50 cathedral, 275° , and Pra Malai, a small, rocky islet, about half a cable offshore in the northern part of the bay, bearing 326° .

Koddiyar bay.—Islets and dangers.—Buoy.—Koddiyar bay is entered between Norway point (page 140) and Marble point, about 4 miles westward. The shores of the bay are low and the Sambore

Chart 815.

and Koddiiyar rivers, Mahaweli ganga and Uppu river flow into the bay.

A shoal bank extends about half a mile north-westward and westward from Norway point, and Norway sand, with depths of less than 5 fathoms (9^m1) over it, extends about 1½ miles southward from the point and about three-quarters of a mile offshore.

Norway islet and Beacon rock are described on page 141. Smooth islet, 33 feet (10^m1) high, lies on Norway sand about 2¼ cables southward of Norway point. Fisherman rocks, 5 feet (1^m5) high, on which is a tree 20 feet (6^m1) high, lie close offshore in the north-eastern part of Sambore bay about three-quarters of a mile south-south-eastward of Smooth islet; Sambore bay is a bight in the coast between a point close northward of Fisherman rocks and the mouth of Sambore river, about 1½ miles south-south-westward.

During the North-east monsoon landing can be effected in boats on the coast under the shelter of Fisherman rocks.

Sambore shoal, with a depth of 16 feet (4^m9) over it, lies about 4 cables north-westward of the mouth of Sambore river; shoals with depths of 21 and 26 feet (6^m4 and 7^m9) over them, lie, respectively, about 6½ cables north-westward, and 8 cables west-north-westward, of the same point.

Koddiiyar sand, with depths of from 3 to 4 fathoms (5^m5 to 7^m3) on its northern edge, fronts the shore for about 2¾ miles between the mouths of Sambore river and Mahaweli ganga at a distance offshore of from 2 to 6 cables. When the rivers are in flood, shoal depths extend farther seaward off the mouth of the latter river and also off the mouth of Koddiiyar river, about one mile westward of Sambore river mouth; in October 1928, an extension of about half a cable was found after heavy rains. Brown shoal, with a least depth of 30 feet (9^m1) over it, lies about 1½ miles north-westward of the mouth of the Koddiiyar river.

Uppu river enters the bay about 1½ miles west-north-westward of the mouth of Mahaweli ganga. Between the mouth of the former river and Marble point, about 2½ miles north-north-eastward, the western shore of the bay is fronted by a shallow flat which extends in places as much as one mile offshore. Tamblegam shoal, with a least depth of 7 feet (2^m1), rock, over it, lies on this flat about one mile northward of the mouth of Uppu river and about half a mile offshore.

Tamblegam spit, which partly dries, extends about three-quarters of a mile south-eastward from the southern side of the entrance to Tambalagam bay (Lake Tamblegam), about one mile north-north-westward of Tamblegam shoal and about 1½ miles west-south-westward of Marble point. Naditivu, an islet 37 feet (11^m3) high with trees and bushes on its summit, is situated on the northern side of the approach to the entrance to the lake, about 8 cables west-south-westward of Marble point. A spit of foul ground extends about a quarter of a mile south-westward of Naditivu and there is also foul ground between the islet and the coast about 1½ cables northward of it.

Elizabeth island (*Lat.* 8° 30' N., *Long.* 81° 13' E.), situated about 9 cables south-eastward of Marble point, consists of bare rock, and has a well-marked summit, 34 feet (10^m4) high; when seen from northward, it has a conical appearance. Except on its eastern side, the island is surrounded to a distance of about 1½ cables by rocks and shoal depths.

Charts 2031, 828, 70.

Chart 816.

Niger rock, a small boulder with a depth of 4 feet (1^m2) over it and surrounded by depths of from 2½ to 4½ fathoms (4^m6 to 8^m2), lies about 4 cables south-eastward of Marble point; a spherical buoy, painted in black and white horizontal bands, is moored close north-eastward of Niger rock (Lat. 8° 30' N., Long. 81° 13' E.).

Chart 815.

Tidal streams.—Current.—In the vicinity of Round island, a stream, apparently tidal, runs in an east-south-easterly and west-north-westerly direction, sometimes attaining a rate of 1½ knots.

Off Norway point, a north-east-going current at a rate of 2 knots, has been experienced setting out of Koddiiyar bay.

Tambalagam bay.—Tambalagam bay is a shallow lagoon about 4 miles long surrounded by low-lying wooded country. The general depths in the bay vary from 2 to 6 feet (0^m6 to 1^m8), mud and sand, with depths of about 7 to 8 feet (2^m1 to 2^m4) in its northern part, and from 7 to 9 feet (2^m1 to 2^m7) in Narche Koudar, its north-eastern arm.

The entrance to the bay is approached between Tamblegam spit which is clearly visible, and the foul ground extending south-westward of Naditivu, and vessels with local knowledge of a draught not exceeding 4 feet (1^m2), can enter the bay. The shores at the entrance are about 1½ cables apart and are connected by a ferry but the navigable channel becomes very narrow close westward of the entrance.

A pier extends about 500 feet (152^m4) south-westward from the shore on the northern side of the entrance, about 3 cables west-north-westward of Naditivu.

Chart 816.

TRINCOMALEE HARBOUR.—General remarks.—Trincomalee harbour may be considered to be the only entirely sheltered natural harbour not only in Ceylon but throughout the whole of the peninsula of India and Pakistan.

It extends for about 3 miles in a northerly direction from the entrance between Elephant point and Clappenburg point, its shores being indented by several picturesque bays and coves separated by hilly, wooded points, and it encloses several islands and islets. There are considerable depths in the entrance and for about 1½ miles within it, but the depths shoal regularly into the various bays and coves.

Danger in entrance.—Light-buoy.—Pandi Aricha Munai paar, a shoal with a least depth of 2½ fathoms (4^m6) over it, lies about 1½ cables east-north-eastward of Clappenburg point; a light-buoy, painted red and exhibiting a *red flashing* light every five seconds, is moored close south-eastward of the shoal.

Western side of Trincomalee harbour.—Dangers.—Buoyage.—Beacons.—The western shore of the harbour is indented by four principal bays containing several coves. Clappenburg bay, lying on the northern side of Clappenburg island (page 143), is separated from Snug cove, about half a mile northward of it, by a peninsula, the summit of which is 101 feet (30^m8) high; French point, the eastern extremity of the peninsula, is situated about 5½ cables west-north-westward of Clappenburg point. Clappenburg spit, with foul ground on its inner part and with depths of 1½ fathoms (3^m2) over its outer part, extends about one cable south-westward from the southern extremity of the peninsula, situated about 1½ cables south-westward of

Chart 816.

French point. A red conical buoy is moored close within the southern extremity of Clappenburg spit (*Lat. 8° 32' N., Long. 81° 12' E.*).

Great Sober island, locally known as Pambuttivu, lies in the south-western part of the harbour, South East head, its south-eastern extremity, being about $5\frac{1}{2}$ cables northward of Clappenburg point ; Gravel hill, a wooded summit, attains an elevation of 231 feet (70^m4) in the centre of the island. On the northern side of the island are several bungalows, a flagstaff and two piers ; there is a small stone jetty, with depths of from 6 to 8 feet (1^m8 to 2^m4) alongside, in Orlando cove on the eastern side of the island. For a distance of about $2\frac{1}{2}$ cables west-south-westward of South East head, the coast is steep and is prominent on account of its bare slopes. A causeway joins the north-western point of the island with a boulder-strewn spit extending north-eastward from the coast about 3 cables northward of the head of Snug cove ; the causeway carries a water pipe-line which continues across the spit to the mainland. French pass lies southward of the causeway.

Little (Small) Sober island, situated close eastward of the southern part of Great Sober island, is connected with the latter by a causeway. A small above-water rock lies close off Eagle point, the eastern extremity of Little Sober island, situated about $7\frac{1}{2}$ cables north-north-eastward of Clappenburg point. A beacon stands close southward of Eagle point and a can light-buoy, painted in red and white vertical stripes and exhibiting a *red flashing light every two seconds*, is moored about half a cable east-north-eastward of the beacon.

A small 7-fathom (12^m8) patch lies about $2\frac{1}{2}$ cables northward of Eagle point and the wreck of a floating dock with the control tower and a crane showing above water, lies about $2\frac{1}{2}$ cables north-north-westward of the same point.

Malay cove lies about half a mile northward of Snug cove and is separated from it by a promontory on which is Southampton hill, 116 feet (35^m4) high. Sister shoal, with a least depth of $1\frac{1}{2}$ fathoms (2^m7) over it, lies near the entrance to the cove, about 9 cables northward of French point ; a 2-fathom (3^m7) patch lies about three-quarters of a cable southward, and Forrester rock, with a depth of $3\frac{1}{4}$ fathoms (5^m9) over it, lies about one cable west-north-westward, of Sister shoal.

A can buoy, painted in black and white chequers, is moored on the southern side of Malay cove, about 2 cables south-westward of Sister shoal.

China bay lies about three-quarters of a mile northward of Malay cove and is separated from it by a promontory on which is Mount Challenger, 183 feet (55^m8) high ; Round point, situated about $1\frac{1}{4}$ miles northward of French point, is the north-eastern extremity of this promontory. Harden point projects north-eastward from the middle of the head of China bay, about 7 cables west-north-westward of Round point, with Railway cove on its northern, and Harden cove on its southern side. A can light-buoy, painted in red and white chequers and exhibiting a *red flashing light every five seconds*, is moored about a quarter of a cable northward of Round point and marks the northern edge of the shore bank surrounding the point.

Round Point shoals are two patches about one cable apart, and about $1\frac{1}{4}$ and 2 cables northward and north-westward, respectively, of

Charts 815, 2031, 828, 70.

Chart 816.

Round point ; there is a least depth of 2 fathoms (3^m7) over the eastern shoal, and 2½ fathoms (4^m6) over the western shoal. The eastern shoal is marked on its south-eastern side by a spherical light-buoy, painted in black and white horizontal bands, and exhibiting
 5 a *white flashing light every six seconds* ; the western shoal is marked by a spherical buoy, painted in black and white horizontal bands, and surmounted by a staff and triangle, moored on the western side of the shoal.

- 10 *Harden* can buoy, painted in black and white chequers is moored close eastward of a 2¼-fathom (4^m1) shoal patch, about 2¼ cables east-south-eastward of Harden point ; *Railway spit* can buoy, painted in black and white chequers, is moored about 4½ cables north-eastward of Harden point and marks the south-eastern side of two shoal patches
 15 with depths of 1½ and 2¾ fathoms (2^m7 and 5^m0) over them.

Cod bay lies northward of China bay and at the head of Trincomalee harbour ; it is entered between Cod point, about one mile north-north-westward of Round point, and Middle point, about 2 cables farther east-south-eastward. Mangrove cove (*Lat. 8° 34' N., Long.*
 20 *81° 12' E.*), on the western side of Cod bay, is separated from North cove on its northern side, by Wemyss point. Mud cove lies on the north-eastern side of Cod bay.

Cod point buoy, a spherical buoy painted in black and white chequers, is moored about a quarter of a cable east-north-eastward of Cod point
 25 and marks the edge of the shorebank surrounding that point. A red conical buoy is moored close south-westward of Middle point and marks the edge of the shore bank surrounding the point, and a white, conical, concrete beacon, surmounted by a triangle, point down, stands about one cable north-eastward of the point.

- 30 The above-mentioned shoals are the outermost dangers on the western side of the harbour ; the position of others may best be seen on the chart.

The land backing the bays and coves on the western side of the harbour is hilly and attains elevations of from 300 to 400 feet (91^m4 to
 35 121^m9).

Piers.—Lights.—Clappenburg wharf lies at the head of Clappenburg bay ; a pier extends southward from the northern side of Snug cove.

- In Malay cove, R.A.F. jetty extends northward from the southern
 40 side of the cove ; two slipways lie westward of it.

On the southern side of China bay, about 3 cables westward of Round point, a T-headed pier extends northward for a distance of about 300 feet (91^m4). A hauling-off wire, kept on this pier, is secured to an anchor which lies about one cable north-eastward ; there is
 45 a one-ton crane on the pier. Another pier extends northward from the shore about one cable westward of the T-headed pier.

Leading marks, from which lights are occasionally exhibited, are established for the eastern approach to this pier ; the front mark is a black pole surmounted by a white triangle situated on the south-eastern corner of this pier ; the rear mark consists of a white line with
 50 black edges painted on the white roof of a corrugated iron shed situated nearly 3 cables west-south-westward of the front mark. These marks in line, bearing 254°, lead between Round Point shoals and Round point.

Charts 815, 2031, 828, 70.

Chart 816.

About $2\frac{1}{2}$ cables westward of the T-headed pier a pier extends north-eastward into China bay for a distance of about 2 cables ; two 2-ton cranes are situated on the inner part of this pier.

A stone jetty, named Firefighting jetty, with a tank at its root, extends eastward for 333 feet (101^m5) from the western shore of Boom cove, on the south-western side of China bay. The jetty is 22 feet (6^m7) wide and, in 1945, had a depth at its head of only one foot (0^m3).

W.A.A.F. pier, a wooden structure, 6 feet (1^m8) wide, on the southern side of Railway cove, had, in 1945, a depth of 5 feet (1^m5) at its head.

Railway pier, extending from the western shore of Railway cove, with depths of about 10 feet (3^m1) at its outer end, is connected to the railway system of the island ; there is a 3-ton crane on the head of the pier.

China Bay wharf, about $1\frac{1}{2}$ cables north-eastward of Railway pier, is constructed from reclaimed land and faced with concrete. There are two berths ; the outer (northern) berth is about 385 feet (117^m4) long with, in 1945, depths of 10 to 11 feet (3^m1 to 3^m4) alongside : the inner (southern) berth is about 415 feet (126^m5) long, with depths of about 5 feet (1^m5) alongside.

Boat Yard pier (*Lat. $8^{\circ} 34' N.$, Long. $81^{\circ} 12' E.$*), on the southern side of Mangrove cove, in Cod bay, is a wooden structure, about 200 feet (61^m0) long and 6 feet (1^m8) wide, with a crane at its head ; in 1945 there was a depth of about 8 feet (2^m4) at the head of the pier.

In North cove, in Cod bay, on the western side of the entrance to the cove and close northward of a slipway, there is an L-shaped jetty with a crane at its northern end.

Mud Cove pier, with a 5-ton crane at its head, lies on the eastern side of Cod bay ; Drum pier lies about one cable south-eastward of it.

Foul ground.—An area of foul ground, indicated on the chart by pecked lines, is situated in the northern part of China bay about one cable eastward of China Bay wharf.

Eastern and northern sides of Trincomalee harbour.—Lights.

—Beacons.—Buoyage.—The southern portion of the eastern shore of Trincomalee harbour is formed by a peninsula consisting of Elephant and Ostenburg ridges, two straight-topped hills lying parallel with each other in a north-easterly direction. The former ridge terminates in Elephant point, the eastern entrance point of Trincomalee harbour, and the latter in Ostenburg point, about $5\frac{1}{2}$ cables north-westward ; between these two points, the coast forms Nicholson cove which extends north-eastward for about 7 cables. Close north-eastward of Ostenburg point is the Naval yard, *see* page 155.

A light is exhibited, at an elevation of 18 feet (5^m5), from a lantern on the south-western corner of a wall, about three-quarters of a cable northward of Ostenburg point.

At the foot, and on the lower slopes of the northern side, of Ostenburg ridge, are the buildings of the naval and military establishments maintained here. Admiralty house, a white, flat-roofed and large building, with a white flagstaff on the centre of the roof, stands close to the coast about $1\frac{1}{4}$ miles north-eastward of Ostenburg point. Admiralty House pier projects about three-quarters of a cable westward from the coast about half a cable south-westward of Admiralty house ; a white signal house, with a flagstaff alongside it, stands close to the root of the pier.

Chart 816.

Two lights, disposed vertically, are exhibited at the head of Admiralty House pier.

Charts 816, 815.

- 5 A flat isthmus joins Ostenburg and Elephant ridges with Fort Frederick, a high and fortified promontory on the outer coast, *see* page 141, and also with Orr's hill and Engineer ridge, a second pair of wooded ridges each about 100 feet (30^m5) high, lying parallel with one another in the northern part of the harbour, about 1½ and 2 miles, respectively, northward of Ostenburg ridge and nearly parallel with it.

Chart 816.

- The town of Trincomalee occupies the greater part of the isthmus, reaching from the outer to the inner coast and, on the latter side, is fronted by lines of islets, shoals and spits, running parallel with the
15 ridges; nearly midway between Ostenburg ridge and Orr's hill, a large spit, on which stand Powder and Little Powder islands (*Lat.* 8° 34' N., *Long.* 81° 13' E.), extends south-westward from the coast of the isthmus, with Powder bay on its north-western, and Kachcheri bay on its south-eastern, side.

- 20 Kachcheri pier extends south-westward from the head of Kachcheri bay, about 4½ cables northward of Admiralty house; there are depths of 6½ feet (2^m0) alongside its head and of 5 feet (1^m5) at some landing steps on its south-eastern side. There is a one-ton crane on the head of the pier. A white pole beacon, surmounted by a white square,
25 stands on the head of Kachcheri pier, and another white pole beacon surmounted by a triangle, stands about 2½ cables north-westward of the root of the pier.

A light is exhibited, at an elevation of 25 feet (7^m6), from a mast on the head of Kachcheri pier.

- 30 Plantain point, situated on the western side of the entrance to Powder bay, about 1½ miles westward of the head of Kachcheri pier, is the south-western extremity of Orr's hill; a white conical, concrete beacon, surmounted by a diamond, stands on the point, and a bungalow named *Sarnia* with a conspicuous white roof, is situated about 2½ cables
35 north-eastward of the beacon and is a useful mark for vessels entering the harbour.

- A shoal spit, on the outer part of which is a rock with a depth of less than 6 feet (1^m8) over it, extends about 1½ cables south-westward from Plantain point; a red conical buoy is moored close south-westward of
40 the outer edge of the spit.

- Chardon pier, a T-headed structure, is situated about 2½ cables east-north-eastward of Plantain point and Welcombe Hotel Cove pier lies about 1½ cables farther north-eastward. A light is exhibited, at an elevation of 10 feet (3^m0), from each of two masts situated one at
45 each end of the T-head of Chardon pier.

Chardon buoy, a can buoy painted in black and white chequers, is moored on the south-eastern side of a 2½-fathom (4^m6) detached patch, situated on the north-western side of the fairway of Powder bay, about 3 cables eastward of the head of Chardon pier.

- 50 Vegetable pier, a stone pier with a L-head, extends about half a cable west-south-westward from the eastern side of Powder bay.

Yard cove is entered between Plantain point and Middle point (page 148) and extends about 1½ miles north-eastward between Orr's hill and Engineer ridge; the depths in the cove shoal to less than

Chart 816.

3 fathoms (5^m5) about 4 cables within the entrance. W.R.N.S. pier is on the eastern, and Native pier on the western, side of the cove ; the former is a wooden pier, 12 feet (3^m7) wide, extending about 139 feet (42^m4) westward, and the latter, also of wood, is 6 feet (1^m8) 5 wide, and extends 64 feet (19^m5) south-eastward.

Islands and dangers on the eastern side of the harbour.—
Buoyage.—Beacons.—Dockyard shoal, situated about 2½ cables northward of Ostenburg point and lying between half a cable and 1½ cables off the eastern shore, consists of two rocky heads with depths 10 of less than 6 feet (1^m8) over them. A conical buoy, painted in red and white horizontal bands, is moored close north-westward of the outer head, and a can buoy, painted in black and white chequers, is moored close southward of the inner head. A black, cylindrical light-buoy, exhibiting a *white flashing light every three seconds*, is 15 moored about a quarter of a cable south-westward of Dockyard shoal.

York island (*Lat. 8° 33' N., Long. 81° 14' E.*), 77 feet (23^m5) high to the tops of the trees, lies about 3 cables south-westward of Admiralty house. York shoal, with depths of from 4 to 5 feet (1^m2 to 1^m5) 20 over it, lies at the south-western extremity of a spit which extends about 4 cables west-south-westward from York island. A detached 3¾-fathom (6^m9) patch lies about 1½ cables east-south-eastward of York shoal. Keroela rock, about three-quarters of a cable northward of York shoal, has a least depth of 2½ fathoms (4^m1) over it. 25

A red conical buoy is moored about a quarter of a cable south-westward of York shoal and a similar buoy is moored on the north-western side of Keroela rock. A red conical light-buoy, exhibiting a *white flashing light every second*, is moored about three-quarters of 30 a cable west-north-westward of York shoal.

A detached shoal with a least depth of 1½ fathoms (2^m3) over it, lies about one cable southward of the south-western extremity of York island and a similar distance westward of Puggett's wharf (page 155) ; it is marked by *Puggett* spherical buoy painted in red and white horizontal bands. Two rocks, one of which is awash, lie about three- 35 quarters of a cable south-south-eastward of the eastern extremity of York island and close westward of the head of Civil Engineer's jetty (page 155).

S. York red conical buoy marks the northern side of a detached 2-fathom (3^m7) patch about 1½ cables north-westward of the north- 40 western extremity of York island. *N. York* red conical buoy marks the northern side of a detached 2½-fathom (4^m6) patch on the south-eastern side of Kachcheri bay, about 2½ cables north-north-westward of the head of Admiralty House pier. Several shoal heads, over which there are depths of from 2½ to 3 fathoms (4^m6 to 5^m5), lie between 45 *S. York* and *N. York* buoys and about 1½ cables west-north-westward of Admiralty House pier.

Powder rocks are a group of low, black rocks, the highest of which is 9 feet (2^m7) high with mangrove bushes on it, and a few scattered boulders, some of which dry ; the group lies near the south-western 50 end of the shallow spit on which stand Powder and Little Powder islands and about half a mile north-westward of York island.

Powder spit mooring light-buoy, painted black and exhibiting a *white flashing light every ten seconds*, marks the western extremity of

Chart 816.

the shoal water surrounding Powder rocks, and *S. Powder* can light-buoy, painted in black and white vertical stripes and exhibiting a *red flashing light every four seconds*, is moored close southward of the southern extremity of the shoal water.

A conspicuous white conical concrete beacon, surmounted by a staff and globe, stands on the south-westernmost of the above-water Powder rocks.

Three rocks with depths of $5\frac{1}{2}$, $5\frac{3}{4}$ and $5\frac{1}{2}$ fathoms (9^m6 , 10^m5 and 10^m6) over them, lie, respectively, 3 cables west-north-westward, $3\frac{1}{2}$ cables westward, and $4\frac{1}{4}$ cables westward, of Powder rocks beacon.

Powder island, situated about 6 cables north-westward of Admiralty house, is connected with the shore north-eastward by a causeway and is covered with trees the tops of which are 30 feet (9^m1) high; it stands on a rocky plateau which dries, and between it and the shore, the depths are less than 3 feet (0^m9).

Little Powder island, about $2\frac{1}{2}$ cables westward of Powder island, consists of a rocky boulder, 10 feet (3^m0) high, and a small sandy islet, 3 feet (0^m9) high, with some mangroves on it, standing on a rocky plateau similar to, but smaller than, that on which Powder island stands. A conspicuous white conical concrete beacon, surmounted by a staff and triangle, stands about a quarter of a cable eastward of Little Powder island.

N.E. Powder conical buoy, the upper half painted white and the lower half red, is moored about $1\frac{1}{4}$ cables north-westward of Little Powder island beacon (*Lat. $8^\circ 34' N.$, Long. $81^\circ 13' E.$*) and marks the north-western edge of the shoal water on the south-eastern side of Powder bay. A similar buoy is moored about $2\frac{1}{2}$ cables north-eastward of the same beacon.

Powder boat passage, lying between Little Powder island and Powder rocks, has a least charted depth of $1\frac{1}{2}$ fathoms (2^m7) in the fairway of the passage; the western end is marked on the northern side by *Mid Powder* cylindrical light-buoy, painted black and exhibiting a *red flashing light every two-and-a-half seconds*, situated about 2 cables west-south-westward of Little Powder island beacon, and on the southern side by *S.W. Powder* red conical buoy, about three-quarters of a cable farther south-westward.

Pinnacle rock, with a depth of $1\frac{1}{2}$ fathoms (2^m7) over it, lies in Kachcheri bay, about $1\frac{3}{4}$ cables southward of Powder island; its southern side is marked by *Pinnacle rock* black cylindrical light-buoy, exhibiting a *red flashing light every six seconds*.

Charts 816, 815.

Signal station.—There is a signal station at Fort Frederick. Day watch is kept and communication can be carried out by means of the International Code of Signals.

Pilots.—There are no licensed pilots at Trincomalee.

Anchorage.—**Mooring buoys.**—H.M. ships usually anchor or moor off the Naval yard in a depth of about 11 fathoms (20^m1), or in the bay northward, off Kachcheri pier and Custom house, but good anchorage can be found in almost any part of the harbour in fine weather.

H.M. vessels use the harbour extensively and have regular anchoring berths. Merchant vessels should therefore keep steam available after anchoring, until the Master Attendant's representative, who is the

Charts 2031, 828, 70.

Charts 816, 815.

Assistant Government Agent, has boarded the vessel and stated that it is not foul of any berth about to be used.

The most sheltered anchorage in the harbour and convenient to the town, will be found in Orlando cove, in depths of 15 fathoms (27^m4), with the north-eastern point of Great Sober island in line with Round point, bearing 316°. 5

A still more convenient and sheltered anchorage is in Dutch bay on the outside coast, which is described on page 144.

There are a number of mooring buoys for the use of dockyard craft, situated close off the Naval yard. There is a target mooring buoy about 2 cables north-westward of the Hospital pier which is situated about 2½ cables southward of the south-western extremity of York island (*Lat. 8° 33' N., Long. 81° 14' E.*), and several mooring buoys between York island and the shore of the harbour south-eastward of it. 10

Quarantine.—Quarantine anchorage.—Vessels without a properly qualified medical officer are not permitted to communicate with the shore, nor to allow any person to board them until permission is given by the Health officer. 20

Cases of infectious disease are not to be landed without the consent of the Government Health officer, even from vessels carrying a properly qualified medical officer.

The regulations governing vessels having on board cases of plague, cholera or yellow fever, and the signals required from all vessels arriving off the port, are the same as those for Colombo, *see* page 99. 25

The infectious diseases hospital stands about 4 cables north-eastward of Plantain point, but it is not visible from seaward.

The quarantine anchorage is at the head of the harbour, off Plantain point. 30

Tidal streams.—Currents.—Little is known of the currents inside the harbour during the South-west monsoon. During November and December, the months with the greatest average rainfall, the surface water is practically always running out of the harbour, at rates of from half a knot to one knot in the centre of the channel, but with a considerably greater velocity near the shore. After passing Elephant point it sets south-eastward with a rate of three-quarters of a knot to one knot. 35

At a depth of 10 fathoms (18^m3), and probably also at lesser depths, the water is generally flowing inwards at a rate rarely more than half that of the outgoing surface water. 40

Directions.—Vessels from southward should pass about 2 miles eastward of Foul point, steering about 314°, until Round island bears 245°, and should then steer for the island on that bearing until the beacon on Clappenburg point bears 295°, when it should be kept on that bearing. When Round island lighthouse bears 169° vessels should alter course northward and keep the lighthouse on that bearing, astern, which leads to the harbour entrance. 45

At night vessels should not bring Foul point light to bear less than 193° until Round island light bears 247°, on which bearing the light changes from *red* to *white*; then steer for Round island light on this bearing, keeping in the *white* sector until Foul point light bears 090°; then alter course westward and keep this bearing on astern, passing through the *red* sector of Round island light between the bearings of 50

Charts 2031, 828, 70.

Charts 816, 815.

226° and 170° ; on entering the *white* sector vessels should alter course northward and keep the light astern in the *white* sector, bearing 169°.

If approaching from northward, vessels should keep Foul point lighthouse (*Lat. 8° 32' N., Long. 81° 19' E.*), bearing 179° until Round island lighthouse bears 236°, then steer for it on that bearing ; when the beacon on Clappenburg point bears 295° the vessel should steer for it on that bearing and proceed as previously directed.

At night, vessels from northward should keep Round island light bearing 236° until Foul point light bears 090°, when the directions given above for vessels from southward, should be followed.

Town.—Trincomalee derives its name from the Tamil name of the headland on which Fort Frederick stands, "Trinkinia malai," signifying "the three-cornered mountain." It is built on the northern part of the isthmus on the north-eastern side of the harbour, the native part being laid out in more or less regular streets. The European bungalows stand in compounds and gardens, in a more scattered manner, southward. There are also some native houses in this locality.

The Kachcheri or Government offices, the post office, and the offices of the Government departments face the north-eastern side of the harbour.

In 1931, the population of Trincomalee was 10,160.

The principal exports are paddy, timber, dried fish, and tobacco, and the chief import is rice.

Climate.—The climate of Trincomalee differs from that of the southern and western coasts of Ceylon, and bears a greater resemblance to that of India southward of Madras.

The temperature during the heat of the day may be considerably over 90° ; the relative humidity at the time, however, is fairly low.

The South-west monsoon brings very little rain to this part of Ceylon. During this monsoon, the wind speed at a well-exposed site on land averages 9 knots, and is probably considerably greater in the harbour. It may cause the whole surface of the harbour to be covered with small breaking waves, sometimes dangerous to boats.

There is a tendency to showers in the afternoon and evening, more marked in the second half of the monsoon, but the rainfall during the South-west monsoon is only small.

At the close of this season, Trincomalee is likely to be affected by depressions from the Bay of Bengal, while the North-east monsoon sets in about the end of November.

Full monsoon conditions of heavy swell on the outer beaches, with wind and rain storms of comparatively short duration, but of extraordinary violence, do not become general until the end of November. During the North-east monsoon, calms are frequent in the morning.

Health.—Trincomalee, on the whole, may be considered healthy, the dry season, from May to September, being the healthiest part of the year. The prevailing diseases are malarial fever and dysentery, which occur chiefly between January and April, when dew falls and the nights may feel chilly ; being succeeded by warm days, care is necessary to guard against changes of temperature.

Chart 816.

Port facilities.—Landing places.—Coal can only be obtained by special arrangement, when it is sent by rail from Colombo to the Railway pier in China bay, whence it is transported to vessels by lighters.

Charts 815, 2031, 828, 70.

Chart 816.

Fresh provisions may be obtained but they are not plentiful. Fresh water is laid on to the piers on the southern side of China bay and can be supplied to vessels at anchor by water boats.

Temporary repairs to vessels can be undertaken. In addition to the cranes on the piers in China bay and on Kachcheri pier, which have already been mentioned, there is a 5-ton and a 2-ton crane at the Naval yard and a 5-ton crane on Pugetts wharf. There is a slipway in the Naval yard, close north-eastward of Hospital jetty.

The Government hospital is near the beach at the southern end of Dutch bay. For the infectious diseases hospital, *see* page 153.

The following are the landing places :—The Naval yard, which is fronted by a stone sea wall, with depths of from 5 to 6 feet (1^m5 to 1^m8) close outside it ; of the two landing steps here, N.H.Q. landing, the north-eastward, has depths of 5 feet (1^m5), and Yard steps, of 3 feet (0^m9) alongside.

Two-fathom and Three-fathom berths, two projections of the sea-wall, lie about three-quarters of a cable and 1½ cables, respectively, south-westward of Yard steps ; *Sagaing*, an off-lying pontoon-shaped structure about 450 feet (137^m2) long, is connected with the shore close north-eastward of N.H.Q. landing ; Hospital jetty, about 1½ cables east-north-eastward of *Sagaing*, has depths of from 4½ to 5 feet (1^m4 to 1^m5) alongside.

Pugett's wharf (*Lat.* 8° 33' N., *Long.* 81° 14' E.), an L-shaped structure, has depths of 7½ feet (2^m3) at its southern, and 6½ feet (2^m0) at its northern corner, but care is necessary when going alongside the latter as there is a line of drying rocks close to it.

Civil Engineer's jetty, about 2½ cables southward of Admiralty House pier, has a depth of 6 feet (1^m8) alongside the head.

Captain's landing, about three-quarters of a cable southward of Admiralty House pier, has a depth of only one foot (0^m3) alongside.

Life-saving.—Three Power lifeboats are maintained.

Climatic table.—*See* page 71.

Chart 815.

FLAGSTAFF POINT TO POINT PEDRO.—**Back bay—Light.—Dangers.**—Back bay, entered between Flagstaff point (page 144) and Elizabeth point, about 3 miles north-north-westward, is largely used during the South-west monsoon by native craft trading with Trincomalee.

The north-western side of Fort Frederick, which forms the south-eastern side of the bay, is rocky at the water's edge with steep wooded and grassy slopes above, but it is not cliffy. Between the root of Fort Frederick promontory and the entrance to Pullai Kulam aru, a large and shallow salt-water lagoon, about 3 miles north-north-westward, the western shore of the bay consists of a smooth sweep of sand.

The Custom house, a distinctive white building near the southern end of the western shore of the bay, about 7 cables west-south-westward of Flagstaff point, is the only prominent object along this shore which, as far as Red bluff, the northern entrance point of Pullai Kulam aru, is low, fringed by coconut trees and backed by a range of wooded hills, from 140 to 180 feet (42^m7 to 54^m9) high, but with no distinctive peaks. Red bluff presents two patches of bare earthy cliffs, 46 feet (14^m0) high and crowned by jungle.

Charts 2031, 828, 70.

Chart 815.

A light is periodically exhibited, at an elevation of 27 feet (8^m2), from a mast at the Custom house.

A reef of rocks, surrounded by foul ground, extends about 3½ cables north-north-eastward from the beach about 6½ cables north-westward of the Custom house ; Bazaar rock, 2 feet (0^m6) high, lies on the outer part of the reef.

Two 5½-fathom (10^m1) patches lie about 2½ cables north-north-westward, and about 4 cables north-westward, respectively, of Flagstaff point.

Fish shoal, with a depth of 28 feet (8^m5) over it, and a favourite fishing ground, lies about 7 cables south-eastward of Red bluff.

Elizabeth point is low and is not easily distinguished, the land within the point being very slightly elevated, wooded and fronted by 15 coconut trees ; a large and prominent tree standing above the others, is situated about 2½ cables westward of the point.

Between Elizabeth point and a position about 4 cables south-westward, the coast is fringed by a coral reef which extends about one cable offshore. A shoal spit, with much foul ground on it, extends 20 about 4½ cables eastward from Elizabeth point and terminates in Lively rocks (*Lat.* 8° 38' N., *Long.* 81° 14' E.), two of which are always above water ; one of the latter is 2 feet (0^m6) high and the sea nearly always breaks over another of these rocks.

Anchorage.—Vessels may obtain anchorage anywhere in Back bay 25 during the South-west monsoon, but in the North-east monsoon it is dangerous. The most convenient berth is in a depth of 7½ fathoms (13^m7), sand, with the detached rock off Flagstaff point bearing 137°, and the dome of the Roman Catholic chapel, 186°.

Fairly good landing may be effected at the mouth of Pullai Kulam 30 aru, when the surf of the North-east monsoon is not too high ; during the South-west monsoon, landing may be easily effected anywhere in the bay.

Chart 2031.

Elizabeth point to Mullaittivu.—Aspect.—From Elizabeth point 35 the coast trends north-westward for about 17 miles to Boulder point. It consists of long sandy beaches fronting several lagoons, all of which have shallow bars at their entrances. The shore generally is well wooded and backed by low hills, of which Nilaveli hill and Pinnacle Rock hill can be clearly distinguished.

40 Between Boulder point and Mullaittivu, about 29 miles farther north-westward, the coast is low and sandy, with occasional rocky outcrops and low cliffs, and is backed by trees and plantations of uniform heights. There are few distinctive features but the red cliffs on the northern side of Black point, about 18 miles north-westward of Boulder 45 point, and, when close inshore, the entrances to the lagoons, are the most easily distinguished.

Submarine Exercise area.—See page 139.

Charts 815, 2031.

Elizabeth point to Shoulder point.—Coast.—Dangers.— 50 Between Elizabeth point and Ava point, about 7 miles north-north-westward, reefs and foul ground extend for over 1½ miles offshore and between the latter point and Shoulder point, about 16 miles farther north-westward, for about one mile offshore ; a number of rocks and shoals, which in 1945 had not been examined, lie off this stretch

Charts 815, 2031.

of coast and other dangers may exist within the 10-fathom (18^m3) line.

Several large boulders lie close off Elizabeth point and continue for a short distance northward, and patches of coral and rocky reefs front the coast between the point and a position about half a mile northward; some boulders 2 feet (0^m6) high, lie about 2 cables offshore on a reef about 4 cables northward of the point.

Malai Porru Putta paar, with a least depth of 14 feet (4^m3) over it, is a dangerous shoal situated about one mile north-eastward of Elizabeth point; it is steep-to and the sea does not break over it. The eastern extremities of Fort Frederick and Chapel island in line, bearing 179°, leads eastward of this danger.

Nilaveli hill (*Lat.* 8° 40' N., *Long.* 81° 12' E.), 180 feet (54^m9) high, lies about 3 miles north-north-westward of Elizabeth point with Nilaveli village about half a mile northward of it; the hill is shaped like a sugar-loaf and is a prominent feature as also are some radio masts, about 1½ miles farther northward. Andamban malai, a rounded hill, 381 feet (116^m1) high, is situated about 5 miles west-north-westward of Ava point and is distinctive; Pinnacle Rock hill, a sharp, finger-like peak, 214 feet (65^m2) high, lies about 1½ miles north-eastward of Andamban malai. Nilappanikkan malai, 391 feet (119^m2) high, is situated about 13 miles west-north-westward of Ava point and about 6½ miles west-south-westward of Boulder point. A flagstaff stands on the coast about one mile south-south-eastward of Ava point.

Fairlie rocks, with depths of less than 6 feet (1^m8) over them, extend about half a mile offshore eastward of Nilaveli hill, and Diomedé rock, a similar danger, lies about 1½ miles north-eastward of Nilaveli hill and about one mile offshore. Two rocks, which dry 2 and 5 feet (0^m6 and 1^m5), lie close together about 9 cables north-north-westward of Diomedé rock and a similar distance offshore.

Chart 2031.

Pigeon island, 99 feet (30^m2) high, situated about 3 miles north-north-eastward of Nilaveli hill, is rocky with shoals extending eastward from it; a rocky islet, 22 feet (6^m7) high, lies about 6 cables south-south-eastward of the island.

Foul ground extends about 1½ miles east-north-eastward of Ava point; Flat rock, 21 feet (6^m4) high, lies about 5 miles north-westward of Ava point and about three-quarters of a mile offshore. Pinnacle rock, 5 feet (1^m5) high, is situated about one mile south-south-eastward of Flat rock, and a shoal area, in which there is a rock with a depth of less than 6 feet (1^m8) over it, extends eastward from Pinnacle rock.

From Ava point, the coast trends north-westward for about 10 miles to Boulder point, the northern of two rocky headlands separated by a sandy bay. A conspicuous framework tower, 200 feet (61^m0) high, stands about three-quarters of a mile southward of Boulder point, and there is another tower on the coast about 3 miles south-south-eastward of the same point.

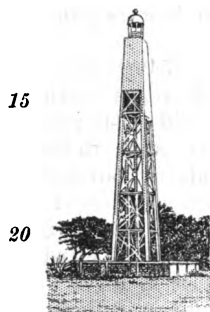
Between Boulder point and Shoulder point, a low, rocky headland about 6 miles north-westward, the coast curves, forming a slight bight; Kunchikumban aru flows into the southern corner of the bight, close westward of the conspicuous framework tower. A group of rocks, one of which is 20 feet (6^m1) high, lies about 2 miles west-north-westward of Boulder point and about one mile offshore; and a dangerous

Chart 2031.

reef on which the sea breaks, and which, in 1945, had not been examined, lies about one mile south-eastward of Shoulder point.

Shoulder point to Mullaittivu.—Coast.—Dangers.—Light.—

- 5 From Shoulder point, which is fringed by a reef extending about 2 cables offshore, the coast trends north-north-westward for about 23 miles to Mullaittivu village. The entrance to Kokkilai lake lies about 4 miles north-north-westward of Shoulder point and about 8 miles north-north-westward of the entrance is Black point, close
10 northward of which are some distinctive reddish cliffs, 120 feet (36^m6) high; the entrance to a lagoon close northward of the cliffs, is also distinctive.



Mullaittivu
light-structure.

- 15 With the possible exception of a 5-fathom (9^m1) patch about one mile north-eastward of Shoulder point, and a 6½-fathom (11^m4) patch about 2 miles east-north-eastward of the entrance to Kokkilai lake, both charted as unexamined, there are no off-lying dangers between Shoulder point and Mullaittivu shoals, *see* below.

- 20 A light is exhibited, at an elevation of 79 feet (24^m1), from an iron framework obelisk, with a dome top, 77 feet (23^m5) in height, situated in Mullaittivu village (*Lat.* 9° 16' N., *Long.* 80° 49' E.).

- 25 **Anchorage.—Landing.**—In the South-west monsoon vessels may obtain sheltered anchorage up to 2 miles from the shore southward of Boulder point, in depths of from 10 to 15 fathoms (18^m3 to 27^m4), mud; and farther north-westward along the coast in depths of from 9 to 10 fathoms (16^m5 to 18^m3).

- 30 Landing may be effected, during the South-west monsoon, at Boulder point, Shoulder point, and close northward of the entrance to Kokkilai lake, though the swell is liable to be heavy. The most sheltered landing place on this stretch of coast is close southward of the light-structure at Mullaittivu.

- 35 Landing is always dangerous during the North-east monsoon.

- Directions.—Caution.**—Vessels should not approach the coast within a distance of 2 miles except in clear weather, and even in clear weather, southward of Boulder point, strict attention to the depth is necessary, as inside the 10-fathom (18^m3) line other dangers may exist.
40 At night, or in thick weather, a vessel should not approach the coast between Elizabeth point and Pigeon island into a depth of less than 25 fathoms (45^m7).

- Mullaittivu shoals.**—Mullaittivu shoals, with depths of less than 5 fathoms (9^m1) over them, extend about 5 miles north-north-eastward
45 from the coast abreast Mullaittivu village. The depths in the southern portion vary from less than 6 feet to 4½ fathoms (1^m8 to 8^m2); the northern part consists of knolls with depths of from 2½ to 4½ fathoms (5^m0 to 8^m7). During the North-east monsoon, the sea breaks heavily on the northern side of the shoals. Vessels should not approach
50 within depths of 20 fathoms (36^m6) when passing these shoals.

Mullaittivu to Kaddaikadu.—Coast.—Off-lying dangers.—A prominent monument stands on the coast about 2 miles north-westward of Mullaittivu light-structure and there is a conspicuous hillock about 4½ miles north-westward of the same point. At Chalai,

Charts 2031.

about 8 miles north-westward of this hillock, there is a gap in the coast which is distinctive between the bearings of 200° and 248° , and on the north-western side of the gap is a conspicuous tree. Depths of 3 fathoms (5^m5) or less extend as much as half a mile from the coast in the vicinity of Chalai gap. 5

About $3\frac{1}{2}$ miles north-westward of Chalai, there is another very distinctive gap in the coast, with a conspicuous tree close south-eastward of it, and about $2\frac{1}{2}$ miles farther north-westward is Chundikkulam, south-eastward of which are several other gaps which are not always visible, but are prominent at times. About 8 miles north-westward of Chundikkulam is Kaddaikadu, where there is a church which is prominent between the bearings of 180° and 200° . 10

An extensive shoal, with depths of from $4\frac{1}{2}$ to 6 fathoms (7^m8 to 11^m0) over it, lies parallel with the coast and about 5 miles from it between Mullaittivu and a position about 6 miles east-north-eastward of Chundikkulam; this shoal is an extension north-westward of Mullaittivu shoals. A detached $5\frac{1}{2}$ -fathom (10^m1) patch lies off the north-western end of the shoal, about $5\frac{1}{2}$ miles north-eastward of Chundikkulam. 15 20

*Charts 2197, 2031.***Kaddaikadu to Point Pedro.—Coast.—Beacons.—Light.—**

From Kaddaikadu, the coast trends north-westward for about $21\frac{1}{2}$ miles to Point Pedro, the north-eastern extremity of Ceylon. A beacon, consisting of a conspicuous white obelisk, known as Pedro channel south obelisk, 50 feet (15^m2) in height and surmounted by a white diamond, the top of which has an elevation of 73 feet (22^m3), stands on the coast about 2 miles north-westward of Kaddaikadu. St. Antony's church stands near the coast at Talaiady, about $4\frac{1}{2}$ miles north-westward of the obelisk, and St. Mary's church at Kudarppu, about 4 miles farther north-westward, is visible at intervals between trees. 25 30

A concrete beacon, known as Pedro channel middle beacon, 50 feet (15^m2) in height and painted in black and white horizontal bands, the top of which has an elevation of 55 feet (16^m8), stands on the coast about $1\frac{1}{4}$ miles north-north-westward of St. Mary's church. 35

Some conspicuous sand dunes are situated close within the coast about $4\frac{1}{2}$ miles north-westward of St. Mary's church at Kudarppu. About $1\frac{1}{2}$ miles north-north-westward of the sand dunes, is a Hindu shrine which is visible from seaward, and close to it is a red-roofed church. At Manalkadu (Manatkadu), about one mile farther north-north-westward, and also at Katkovalam, about $2\frac{1}{2}$ miles north-north-westward of Manalkadu, there are several other Hindu shrines; in 1948, Manalkadu church was reported to be distinctive between the bearings of 188° and 270° . Between Katkovalam and Point Pedro, about $1\frac{1}{4}$ miles north-north-westward, the coast is lined with casuarina trees and palms, about 70 feet (21^m3) high. 40 45

Point Pedro light is exhibited, at an elevation of 103 feet (31^m4), from a white circular tower, 105 feet (32^m0) in height, situated on Point Pedro (*Lat.* $9^{\circ} 50' N.$, *Long.* $80^{\circ} 15' E.$).

Off-lying danger.—Point Pedro shoal, with depths of less than 5 fathoms (9^m1) over it, extends about 23 miles south-eastward from a position abreast Point Pedro, and several miles north-westward into the entrance of East channel, which leads into Palk strait. The shoal lies between 3 and 5 miles from, and approximately parallel with, the

Charts 2197, 2031.

coast between Kaddaikadu and Point Pedro. The two shoalest heads are Stork and Ethiopia shoals; the former, with a depth of one fathom (1^m8) over it, is situated about 6 miles east-south-eastward of Point
 5 Pedro and about 4½ miles offshore; and the latter, with a depth of 1½ fathoms (2^m3) over it, lies about 9 miles south-eastward of the same point and about 4 miles offshore. There are depths of from 6½ to 8 fathoms (11^m4 to 14^m6) in the fairway of Pedro channel, the passage between Point Pedro shoal and the coast.

- 10 **Anchorage.—Prohibited anchorage.**—Except in the prohibited area, *see* below, vessels may obtain good anchorage in any part of Pedro channel in cases of necessity.

Anchorage is prohibited in an area of Pedro channel indicated by pecked lines on the chart, extending for a distance of 3 miles from the
 15 coast between positions about 6½ miles south-eastward, and 2½ miles westward, of Point Pedro.

Directions.—Between Pigeon island and Point Pedro, if passing outside Point Pedro shoal, vessels should not approach the land within a depth of 20 fathoms (36^m6) by day, or within 25 fathoms (45^m7)
 20 at night.

If passing between Point Pedro shoal and the main island, vessels having passed Mullaittivu shoals in a depth of not less than 20 fathoms (36^m6), should not approach the coast north-westward of these shoals within a depth of 10 fathoms (18^m3) until the white obelisk bears
 25 between 280° and 290°. Bearing in mind that discoloured water and shoaler depths than charted have been reported in the vicinity, vessels should only approach the coast with the obelisk between these bearings, which leads southward of the south-eastern end of Point Pedro shoal, after clearing which, course should be altered north-westward
 30 and the coast kept at a distance of about 1½ miles.

Caution.—Between Mullaittivu and Point Pedro, a red sand-haze forms over the land during south-westerly winds; this may reduce the visibility of objects on the coast to about 3 miles. Under these conditions it is better to make Mullaittivu lighthouse rather than the
 35 obelisk.

The best time to make the obelisk is during the forenoon, so as to arrive at the southern end of Pedro channel about noon. The obelisk will then be visible from northward until the high trees and lighthouse at Point Pedro are identified, and there will be no difficulty in avoiding
 40 Ethiopia shoal (*Lat.* 9° 45' N., *Long.* 80° 23' E.).

Charts 68a, 828, 70.

CHAPTER III

PALK STRAIT AND BAY

Chart 68a.

PALK STRAIT.—Depths.—Palk strait, which forms the northern entrance to Palk bay, lies between the northern coast of Ceylon and the eastern coast of India. The strait is largely occupied by banks with depths of from 3 to 5 fathoms (5^m5 to 9^m1), and by numerous shoals with less depths over them. 5

There are three principal entrance channels of which the southern channel carries a depth of $4\frac{1}{2}$ fathoms (8^m2), the middle channel, a depth of $3\frac{1}{2}$ fathoms (6^m9), and the northern channel a depth of $3\frac{1}{2}$ fathoms (5^m9). 10

The southern channel, which is divided into two parts known as East channel and West channel, and the northern channel, are those generally used by local vessels; large vessels entering Palk bay use Pedro channel and West channel, in which a depth of $5\frac{1}{2}$ fathoms (10^m1) can be carried by vessels with local knowledge. For further details of channels, *see* page 164. 15

Chart 2197.

Southern shore of Palk strait.—Coast.—Lights.—The southern shore of Palk strait is formed by the northern coast of Jaffna peninsula which extends about 21 miles west-south-westward from Point Pedro (*Lat.* $9^\circ 50' N.$, *Long.* $80^\circ 15' E.$). This stretch of coast is formed of coral sand interspersed with salt water lagoons and stony plains, and is generally low with low coral cliffs and sandhills on it which are occasionally visible from seaward. 20

Jaffna peninsula forms the northernmost part of Ceylon and is the most fertile portion of the island, the land being irrigated from numerous wells. Various kinds of vegetables are grown, and tobacco forms the chief crop. 25

Point Pedro is the north-eastern extremity of Jaffna peninsula; as stated on page 159, trees and palms about 70 feet (21^m3) high, extend along the coast for a distance of about $1\frac{1}{2}$ miles south-south-eastward of the point. About three-quarters of a mile westward of the point is the town and port of Point Pedro where there is a Custom house with a prominent red roof. There are several bungalows on the beach in this vicinity, and a small pier equipped with a crane extends from the coast abreast the Custom house. 30

Point Pedro light is described on page 159. A light is exhibited from the head of the Custom house pier.

Charts 68a, 828, 70.

Chart 2197.

There is a boat channel through the reef abreast the Custom house. The port is open from about mid-February to mid-October.

From Point Pedro, the coast trends west-north-westward for about 5 2½ miles to Palmyra point, the northernmost extremity of Ceylon, and thence west-south-westward for about 4½ miles to Tondaimanar, which is marked by a cliff 25 feet (7^m6) high. Palmyra and coconut palms, from 70 to 90 feet (21^m3 to 27^m4) high, line the whole of this stretch of coast which is fringed by a narrow reef extending from half a cable to 10 one cable offshore. There are breaks in the reef affording good boat entrances at Palmyra point and at Valvedditturai, about 2½ miles farther west-south-westward.

About half a mile westward of Tondaimanar is a boat entrance to a lagoon which, from northward, shows as a gap and serves as a leading 15 mark for East channel, *see* page 165.

Between Tondaimanar and Kankesanturai, about 5½ miles westward, the coast is stony, fringed with reef, and lined with palms from 70 to 90 feet (21^m3 to 27^m4) high. Vessels should not approach within half a mile of this stretch of coast.

20 *Chart 2197, plan of Kankesanturai anchorage.*

Kankesanturai. — Lights. — Anchorage. — Kankesanturai (Lat. 9° 49' N., Long. 80° 03' E.) is the chief port of call on the northern coast of Ceylon for vessels during the South-west monsoon and it has a considerable trade with ports in the southern part of India. There is 25 a Custom house and the Customs Officer is the representative at the port for the Master Attendant.

A conspicuous chimney, about 200 feet (61^m0) in height, is situated about one mile west-south-westward of Kankesanturai and there are two radio masts at Jaffna airport which is in the vicinity of Kankesanturai. There are two stone bastions on the beach, and there is 30 a small wooden pier, with a depth of 4 feet (1^m2) at its head, and 3½ feet (1^m0) at the steps on the western side, which boats can make use of during the South-west monsoon. There is a hand derrick on the pier with a lifting capacity of 2 tons. Cargo boats, which may 35 be used as lighters, anchor off the beach and can be obtained during fine weather.

There is occasional communication by steamer with other ports. The town is connected to the railway system of the island. A small stock of coal is usually maintained.

40 A light is exhibited, at an elevation of 81 feet (24^m7), from a circular masonry tower, 73 feet (22^m3) in height, near the western bastion.

A light is exhibited from the head of the pier.

Anchorage may be obtained, in a depth of 5 fathoms (9^m1), sand and mud, with the lighthouse bearing 203°, distant about 3½ cables, and 45 a rocky point about 1½ miles westward, bearing about 258°. Westward of the lighthouse the bottom is foul.

Chart 2197.

Coast.—Light.—From Kankesanturai, the coast, which is lined with palmyra and coconut palms and fringed by a coral reef, trends 50 west-south-westward for about 9 miles to the north-western extremity of Jaffna peninsula; there is a conspicuous sandhill on this stretch, about one mile westward of Matakai, a village about 5 miles west-south-westward of Kankesanturai. At the north-western extremity of Jaffna peninsula, the coast turns south-south-eastward and forms the

Chart 2197.

eastern side of a shallow channel, about 3 cables wide at its entrance, which separates Jaffna peninsula from Karaitivu and other islands. The entrance to this channel is encumbered by numerous rocks and shoals which close it to navigation except for boats. 5

Karaitivu is the northernmost island of a group situated westward of Jaffna peninsula; on the north-eastern point of Karaitivu, which forms the western entrance point of the channel separating it from the peninsula, is a sandhill, 20 feet (6^m1) high on which are some palms, and which is prominent from north-westward. About 1½ miles south-south-eastward of this sandhill is a low coral island covered with trees which attain an elevation of about 90 feet (27^m4) on its north-western point; close southward of this island is a causeway which connects Karaitivu with Jaffna peninsula. 10

A light is exhibited, at an elevation of 100 feet (30^m5), from a white masonry tower, 97 feet (29^m6) in height, on Kovilan point (*Lat.* 9° 46' N., *Long.* 79° 52' E.), the north-western extremity of Karaitivu, about 2 miles westward of the prominent sandhill on its north-eastern point. 15

Dangers.—Buoy.—Caution.—A bank on which the depths are 3 fathoms (5^m5) and less, extends as much as 2 miles offshore in places between a position about 4 miles westward of Kankesanturai and the north-western extremity of Jaffna peninsula. A 1½-fathom (3^m2) coral patch lies near the outer edge of the bank, about 1½ miles north-westward of the conspicuous sandhill westward of Matakai, and between this patch and the coast the bottom is uneven and foul. 20 25

A flat, on which the depths are less than 3 fathoms (5^m5), fronts the western side of Karaitivu and extends as much as 3 miles offshore. Northward and north-westward of this flat and with Kovilan lighthouse bearing between 125° and 075°, there are several shoals with depths of from 2 to 3 fathoms (3^m7 to 5^m5) over them; the outermost of these shoals, with a least depth of 2½ fathoms (4^m1), lies about 5½ miles west-north-westward of Kovilan lighthouse. A can buoy, painted black and equipped with a radar reflector, in the form of a cage topmark, is moored about 3 cables northward of the outermost shoal. 30 35

The above-mentioned shoals, composed of hard sand with coral probably underlying them, are surrounded by depths of from 3½ to 5 fathoms (5^m9 to 9^m1). Great care should be exercised to avoid them by keeping well in the middle of the fairway when navigating West channel, *see* page 165. 40

Chart 68a.

North-western shore of Palk strait.—Light.—The north-western shore of Palk strait is formed by the low-lying coast between Point Calimere, situated about 35½ miles north-westward of Point Pedro, and a low point which projects eastward close southward of the entrance to Vellar river, about 40 miles west-south-westward of Point Calimere. The coast northward of Point Calimere is described on page 176. 45

Point Calimere light is exhibited, at an elevation of 44 feet (13^m4), from a concrete tower, 60 feet (18^m3) in height, situated close within the point. 50

A drying sandbank, inside which native craft find shelter in bad weather, extends about 1½ miles north-eastward from Point Calimere.

The land in the vicinity of Point Calimere is a Government forest

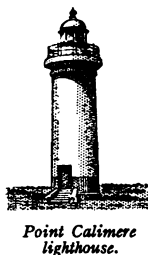
Chart 68a.

reserve where antelope, spotted deer and wild pigs are strictly preserved. Landing or shooting in the neighbourhood is prohibited.

5

10

15



Point Calimere
lighthouse.

Between Point Calimere and Adirampatnam, about 29 miles westward, the coast consists of mud flats covered with mangrove bushes and is flooded during heavy rains and high spring tides. Kodigeri bungalows, formerly a hot weather resort, are situated close within the coast about 3 miles westward of Point Calimere.

Adirampatnam. — Light. — Anchorage. —

Adirampatnam is considered a port of refuge for native craft between the months of May and September; it has a considerable native trade, principally with Ceylon. The port is connected with the South

Indian railway. In 1951, the population was about 13,000.

A light is exhibited, at an elevation of 38 feet (11^m6), from a white mast, 60 feet (18^m3) in height, at Adirampatnam (*Lat.* 10° 20' N., *Long.* 79° 23' E.).

Anchorage may be obtained, in depths of about 3½ fathoms (5^m9), soft mud, about 4½ miles off the town, with the light-structure bearing 000°, and Shaullavanaigenpatam column, which is situated about 6 miles south-westward of the town and is visible 15 miles, bearing 281°; small vessels may anchor closer to the town. With southerly or south-easterly winds a heavy swell sets on to this coast rendering the anchorage unsafe, but during the North-east monsoon, it is considered good.

Coast.—Danger.—From Adirampatnam, the coast trends in a wide curve to a low projecting point on the southern side of Vellar river about 19 miles south-south-westward. A spit of hard sand with depths of less than 3 fathoms (5^m5) over it extends about 13 miles east-south-eastward from the point with a detached 3-fathom (5^m5) patch about one mile south-eastward of its extremity. A heavy sea generally prevails over this spit and it should not be approached from eastward within a depth of 6 fathoms (11^m0).

The coast south-westward of the low point is described on page 174. *Chart 2197.*

Dangers in Palk strait.—South banks consist of a number of shoals with depths of less than 3 fathoms (5^m5) over them, situated between 9 and 14 miles northward of the coast between Kankasanturai (*Lat.* 9° 49' N., *Long.* 80° 03' E.) and Karaitivu. The least depth over South banks is 2½ fathoms (4^m6), over a shoal situated about 13 miles north-north-westward of Kankasanturai lighthouse. Depths of less than 5 fathoms extend about 12 miles eastward from the shoalest part of South banks towards Point Pedro shoal.

Chart 68a.

Middle banks consist of a number of shoals, with depths of less than 3 fathoms (5^m5) over them, situated between 4 and 12 miles southward of Point Calimere. The least depth over Middle banks is 1½ fathoms (2^m3), over a shoal, named Eight Foot patch, situated about 6½ miles southward of the point.

Chart 2197.

Channels.—The southern channel consists of East channel and West channel, the former of which lies between Point Pedro shoal

Chart 2197.

and South banks and has a least depth of 4 fathoms (7^m3). West channel lies between South banks and the shoal water which extends north-westward from Karaitivu, and has a least depth of 5½ fathoms (10^m1) in the fairway, but in 1944 a least depth of 35 feet (10^m7) could be carried through West channel over a width of 3 cables by vessels with local knowledge. 5

Chart 68a.

Middle channel lies between South banks and Middle banks; it is about 4 miles wide with a least depth of 3¼ fathoms (5^m9), but there is a channel about one mile wide, in the centre of Middle channel, with a least depth of 3½ fathoms (6^m9). 10

The northern channel lies between Middle banks and Point Calimere, and has a least depth of 3¼ fathoms (5^m9) over a width of about 1½ miles between the shorebank fringing Point Calimere and a 2¼-fathom (4^m1) patch about 4 miles south-south-eastward of that point. 15

Large vessels should use Pedro and West channels, through which the least depth in the fairway is 5½ fathoms (10^m1).

Tidal streams and currents.—The tidal streams in Palk strait and Palk bay are irregular, being influenced by the prevailing winds, but during February, March and April they are more regular, changing approximately every 6½ hours at high and low water in the bay, and setting westward during the falling tide, and eastward during the rising tide at Trincomalee (*Lat. 8° 34' N., Long. 81° 14' E.*). 20

From West channel to Delft island, about 18 miles south-westward of Karaitivu, the tidal streams follow the general directions of the coast, setting south-westward and south-eastward during the falling tide at Trincomalee. The rate of the streams at springs is nearly one knot in Delft channel and about three-quarters of a knot in West channel. 25 30

During February, March, and April, in a calm, there is no current in the entrance to Palk bay, but it generally sets with the wind, except in May and October, when it is very variable.

In the middle of Palk bay the current sets leeward in either monsoon.

A set out of Palk strait is usually found when the current is running northward in the offing, and it is presumed that the reverse takes place when the current runs southward. Close inshore, tidal streams are felt, and they vary the strength of the current in the neighbourhood of Middle banks. 35

Charts 68a, 2197.

Directions.—Vessels intending to enter Palk bay through the southern channel should make for a position about 12 or 13 miles northward of Tondaimanar, and when Tondaimanar gap (page 162), can be distinguished, it should be kept bearing 185°; when the depths increase to 6 fathoms (11^m0), course should be altered westward towards the entrance to West channel, keeping in depths of from 6 to 7 fathoms (11^m0 to 12^m8). 40 45

Having arrived at a position at the eastern entrance to West channel with Kovilan lighthouse bearing about 158°, and the obelisk on the northern end of Analativu (*see* page 166), bearing about 207°, a course of 281° should be made good through West channel. *See* caution on page 163. 50

Middle channel is out of sight of land and the latitude is the only guide.

Charts 828, 70.

Charts 68a, 2197.

Vessels intending to enter Palk strait through the northern channel should sound continuously and, if coming from south-eastward, should not get into depths of less than 8 fathoms (14^m6) until Point Calimere (Lat. 10° 18' N., Long. 79° 52' E.) is made out.

Caution.—Numerous fish traps, to which are attached large blocks of wood and 3½-inch coir moorings, exist off the northern coast of Ceylon; these constitute a danger to powered vessels, especially at night.

10 Chart 68a.

PALK BAY.—Depths.—Palk bay, the continuation southward of Palk strait, is bounded on the east by the northern coast of Ceylon, on the south by the islands of Mannar and Pamban, with their shoal connection known as Adam's bridge, and on the west by the coasts of the Ramnad and Tanjore districts of Madras.

The general depths in the bay are from 6 to 7 fathoms (11^m0 to 12^m8) but on its eastern side depths of 5 fathoms (9^m1) and less extend as much as 15 miles from the coast of Ceylon, and within it are several islands, rocks and shoals; on the southern side there are depths of less than 5 fathoms (9^m1) within 5 miles of the coast in places.

Charts 2197 and 69.

North-eastern side of Palk bay.—Islands and dangers.—

Beacon.—Light.—A flat, with depths of less than 3 fathoms (5^m5) over it, extends about 10 miles westward from the western end of Jaffna peninsula, and on this flat are a number of islands and shoals which enclose a large basin with depths of from 1½ to 1¾ fathoms (2^m3 to 3^m2).

Karaitivu, the northernmost of these islands, is described on page 163.

Eluvativu, situated about 2½ miles west-south-westward of the southern end of Karaitivu, is low and covered with trees from 75 to 80 feet (22^m9 to 24^m4) high.

Analativu, situated about 1½ miles south-westward of Eluvativu, is covered with trees from 70 to 80 feet (21^m3 to 24^m4) high and on its northern end is a conspicuous white obelisk, 80 feet (24^m4) in height, and with an elevation of 88 feet (26^m8). Parititivu, 15 feet (4^m6) high, lies between the southern end of Eluvativu and the northern end of Analativu; Puliantivu (Pulivativu), also 15 feet (4^m6) high, with numerous palm trees on it and at its southern end a white temple which is difficult to distinguish, lies close off the southern end of Analativu with which it is connected by a bridge.

Nayinativu (Lat. 9° 36' N., Long. 79° 46' E.) lies about 1¾ miles southward of Analativu and has trees about 70 feet (21^m3) high on it. A temple with a red roof stands close within the northern end of the island, and near it a stone pier projects from the eastern side of the island. A conspicuous small temple with a red roof stands at the south-western extremity of the island.

A narrow detached shoal ridge of sand and coral, over which there are depths of from 16 to 18 feet (4^m9 to 5^m5), lies about 6 cables from, and nearly parallel with, the western side of Nayinativu; a 16-foot (4^m9) patch lies in mid-channel between the southern end of this ridge and the coast of Nayinativu.

Punkudutivu, on which there are some palms, lies with its western end separated from Nayinativu by a channel about one mile wide.

Charts 68a, 828, 70.

Charts 2197 and 69.

A mud bank which dries in some places and on which are several islets, extends as much as $1\frac{1}{2}$ miles northward from the northern side of the island.

A light is exhibited, at an elevation of 35 feet (10^m7), from a white tower situated on the coast near the south-eastern extremity of Punkudutivu; the lighthouse is conspicuous.

Velanai, the largest island of the group, lies with its south-western side about $1\frac{1}{2}$ miles north-eastward of Punkudutivu. At its northern end, which is separated from the southern coast of Karaitivu by a narrow channel about a quarter of a mile in width, is the town and port of Kayts, *see* below.

Mandaitivu, separated from the south-eastern end of Velanai by a narrow channel with depths of only from one to 2 feet (0^m3 to 0^m6), lies with its northern end separated from Jaffna peninsula by a shallow channel about $1\frac{1}{2}$ miles wide in which are some islets; these islets are connected by causeways with the south-eastern end of Velanai and the northern end of Mandaitivu and there is a ferry jetty on the north-easternmost islet. The northern end of Mandaitivu is marshy but there are some coconut palms on its southern end.

Chart 2197.

Kayts.—Anchorage.—Directions.—The port of Kayts is situated on the northern coast of Velanai, near the middle of the southern side of the narrow channel which separates that island from Karaitivu. The port is open throughout the year but is most frequented during the South-west monsoon. The entrance, which lies between the south-western extremity of Karaitivu and the north-western extremity of Velanai, is approached across the flats between the former island and Eluvativu and south-westward of Fort Hammenhiel, the quarantine station, situated about a quarter of a mile south-westward of the south-western extremity of Karaitivu.

Powered vessels may obtain anchorage in depths of about 4 fathoms (7^m3), sand, with the northern point of Eluvativu bearing 135° , distant about one mile. Small native vessels lie in the outer anchorage, in depths of from 2 to 3 fathoms (3^m7 to 5^m5), from $1\frac{1}{2}$ to 3 miles westward of Fort Hammenhiel, and discharge part of their cargo before entering the port.

Small vessels bound for Kayts harbour should approach keeping Fort Hammenhiel (*Lat.* $9^\circ 43' N.$, *Long.* $79^\circ 51' E.$) bearing 146° which leads over the flats in the greatest depths; when the fort is distant about one mile and the depth is 9 feet (2^m7), course should be shaped to round the fort on its southern side at a distance of about 3 cables; then, keeping on the northern side of the channel until past a bungalow on the shore, vessels may obtain anchorage, in a depth of about 2 fathoms (3^m7), mud, off Kayts Custom house, about $1\frac{1}{2}$ miles eastward of the north-western extremity of Velanai. The least depth on this route is 6 feet (1^m8).

Chart 69.

Delft island. — Beacons. — Light. — Anchorage. — Delft island, situated about $4\frac{1}{2}$ miles south-westward of Nayinativu, is separated from the group of islands described above by Delft channel. There are palm trees from 70 to 80 feet (21^m3 to 24^m4) high on the north-eastern and western parts of the island, while the southern part is grass land, divided by loose stone walls with trees about 20 feet

Charts 68a, 828, 70.

Chart 69.

(6^m1) in height. A shallow salt water lake occupies the centre of the island and, when seen from some distance northward, Delft island appears as two islands.

- 5 The north-western and south-eastern extremities of Delft island are marked by beacons. The former is a white, iron framework beacon, 53 feet (16^m2) in height and surmounted by a white disc; the disc faces westward and has an elevation of approximately 60 feet (18^m3). The latter beacon is a white brick tower, 40 feet (12^m2) in height, the
10 top of which has an elevation of 48 feet (14^m6). Both beacons are conspicuous.

A light for the use of fishing craft is exhibited, at an elevation of 25 feet (7^m6), from an iron beacon, on the north-eastern extremity of Delft island.

- 15 Delft island is nearly steep-to except on its northern side where depths of less than 5 fathoms (9^m1) extend about 7 miles north-north-eastward, and off its north-eastern extremity where depths of 5 fathoms (9^m1) or less extend about 2½ miles north-eastward, and a detached 23-foot (7^m0) patch lies about one mile east-south-eastward of the
20 light-beacon and about 6½ cables offshore.

There is a small boat harbour near the north-eastern extremity of the island, close westward of the light-beacon. The entrance is marked by two small beacons and there is a small jetty inside. There is a least depth of 6 feet (1^m8) seaward of these beacons, but the depths
25 shoal rapidly inside the harbour.

During strong north-easterly winds, temporary anchorage may be obtained off the western side of Delft island with the southern end of the high trees bearing about 067°.

- Kachchaitivu.**—Kachchaitivu (Kachchtivu), 39 feet (11^m9) high
30 and covered with scrub, lies about 10 miles south-westward of Delft island; there is a well and a small shrine on its south-eastern side. The island is visited by fishermen but is otherwise uninhabited. Depths of less than 5 fathoms (9^m1) extend about one mile from the south-eastern end of the island.

- 35 **Delft channel.—Dangers.**—The fairway of Delft channel has a least depth of 5 fathoms (9^m1) over a width of about 1½ miles between the 5-fathom (9^m1) contour lines off Nayinativu and the north-eastern extremity of Delft island, and a depth of 5 fathoms (9^m1) can be carried over the northern end of the shoal bank which extends north-north-
40 eastward from the latter island. On the eastern side of the channel the dangers consist of the detached shoal ridge fronting Nayinativu, and the shorebank extending southward and south-eastward from that island. On the western side of the channel, Neduntivu shoal, with depths of from 2 to 3 fathoms (3^m7 to 5^m5) over it, extends from
45 about half a mile to 2½ miles north-north-westward of the north-eastern extremity of Delft island.

Charts 69 and 68a.

Eastern side of Palk bay.—Off-lying islands and dangers.—

- Beacons.**—From Kalmunai point (*Lat.* 9° 36' N., *Long.* 80° 03' E.),
50 the eastern entrance point of Jaffna lagoon, *see* page 169, situated about 3 miles eastward of Mandaitivu, the eastern side of Palk bay curves in a wide bight to Devil's point, about 13 miles southward, and thence forms another bight between the latter point and the eastern extremity of Mannar island, about 26 miles south-south-westward;

Charts 828, 70.

Charts 69 and 68a.

almost the whole of both these bights are encumbered with shoals and extensive banks of mud and sand with some islets.

A white tower, 25 feet (7^m6) in height, stands on the extremity of Kalmunai point ; its top has an elevation of 32 feet (9^m8). 5

There are several small islands off the eastern shore of Palk bay. Kakerativu, the outermost of them, a sandy islet 15 feet (4^m6) high and covered with scrub, lies about 10 miles west-north-westward of Devil's point and about a similar distance east-south-eastward of Delft island. A conspicuous white framework beacon, 53 feet (16^m2) 10 in height and surmounted by a white disc, stands on the south-western side of Kakerativu ; the disc faces westward and has an elevation of 60 feet (18^m3). Two shoals with depths of 15 feet (4^m6) over them lie about a quarter of a mile north-westward, and half a mile north-eastward, respectively, of the islet. Two more shoals with depths of 15 22 and 13 feet (6^m7 and 4^m0) over them, lie, respectively, about 1½ miles south-south-eastward, and 2 miles east-south-eastward, of the islet.

Palativu lies off the northern bight in the eastern shore of Palk bay, about 7½ miles east-north-eastward of Kakerativu ; except at its southern extremity, it is covered with coarse grass and scrub, from 15 to 20 feet (4^m6 to 6^m1) high. A bank on which the depths are less than 3 fathoms (5^m5) surrounds the greater part of the island especially on its northern and eastern sides, and extends as much as one mile east-south-eastward of its eastern side. A white tower, 25 feet (7^m6) in height, stands near the north-eastern extremity of the 25 island ; its top has an elevation of 31 feet (9^m4).

A rocky shoal with a least depth of 4 feet (1^m2) over it, lies about 4 miles north-westward of Palativu and between the island and this shoal there are three patches with depths of 17, 16 and 18 feet (5^m2, 4^m9 and 5^m5) ; two more 18-foot (5^m5) patches lie about 5 miles north- 30 westward, and about 2½ miles north-eastward, respectively, of Palativu.

A shoal with depths of less than 3 fathoms (5^m5) over it, lies with its centre about 3½ miles east-south-eastward of the southern end of Palativu ; near the western end of this shoal is a rock, awash.

Iranativu North (Tranativu) and Iranativu South (Sinnativu) are 35 two low coral islands separated by a canoe passage, situated close off the southern bight in the eastern shore of Palk bay, about 7 miles south-south-westward of Devil's point. On the northern part of Iranativu North is a village (*Lat. 9° 18' N., Long. 79° 59' E.*) standing amongst palms, two of which were about 55 feet (16^m8) high in 1944, 40 and near the north-eastern extremity of the island is a tower which has an elevation of 53 feet (16^m2). There is a fishing village on the south-eastern side of Iranativu South, and on its north-eastern side there was, in 1944, a conspicuous tree 45 feet (13^m7) high. There are wells on both islands. 45

Chart 69.

Jaffna and approaches.—Light.—Jaffna, the principal town of Jaffna peninsula, is situated on the northern shore of Jaffna lagoon, about 4 miles north-westward of Kalmunai point. Jaffna lagoon is a large and shallow expanse of water which is entered between Man- 50 daitivu and Kalmunai point and extends east-south-eastward as far as Chundikkulam (page 159) on the eastern coast of Ceylon, where a narrow strip of land connects Jaffna peninsula with the mainland.

A light is exhibited, at an elevation of 20 feet (6^m1) from Jaffna

Chart 69.

obelisk, a white concrete tower situated about 2 miles north-westward of Kalmunai point; it marks the western side of the entrance to a channel across the lagoon leading to the port of Jaffna.

- 5 The Government Agent is the Master Attendant and Collector of Customs at the port. There are special regulations in force with regard to the hire of boats for landing and embarking cargo. The town, which in 1931 had a population of 45,708, is connected to the railway system of Ceylon.

- 10 **Life-saving.**—A Power lifeboat is maintained.

Winds.—The North-east monsoon prevails at Jaffna from the end of November to February and the South-west monsoon from the middle of May till October. During March and the first half of April, the prevailing wind is south-easterly.

Chart 68a.

- Southern side of Palk bay.—Mannar island.—Lights.**—Mannar island, situated at the south-eastern corner of Palk bay, about 48 miles southward of the western extremity of Jaffna peninsula, is separated from the mainland of Ceylon by a boat channel which is crossed by
20 a railway bridge and a road bridge, and which has a bar at either end. The port of Mannar, situated on the north-western side of the channel, affords shelter to small vessels with local knowledge; a Customs officer at each bar examines vessels entering. The town of Mannar, situated at the head of the port, is surrounded by coconut trees. In
25 1931, the population was 4,084.

Chart 69.

- Pesalai, a small port on the northern coast of Mannar island, about $8\frac{1}{2}$ miles north-westward of the town of Mannar, affords good shelter during the South-west monsoon. An old brick watch tower stands
30 near the coast about $2\frac{1}{4}$ miles east-south-eastward of Pesalai.

- Talaimannar, situated near the western end of Mannar island, about $5\frac{1}{2}$ miles westward of Pesalai, is connected to the railway system of Ceylon. A pier projects 865 feet (263^m6) northward from the northern coast of the island, about one mile northward of Talaimannar; there
35 is a double railway track on the pier and there are depths of 10 feet (3^m0) alongside its head.

A light is exhibited, at an elevation of 55 feet (16^m8), from a conspicuous white concrete tower, 64 feet (19^m5) in height, situated at the root of the pier.

- 40 A light is occasionally exhibited, at an elevation of 25 feet (7^m6), from an iron column, 20 feet (6^m1) in height, situated on the head of the pier.

A disused lighthouse, consisting of a conspicuous black steel framework tower, 92 feet (28^m0) high, stands on the western extremity of Mannar island, about $1\frac{1}{4}$ miles westward of Talaimannar.

- 45 There is regular steamer ferry service between Talaimannar pier and Dhanushkodi (*Lat.* $9^{\circ} 11' N.$, *Long.* $79^{\circ} 25' E.$), the terminus of the South Indian railway, situated on Pamban island about 18 miles west-north-westward.

- Adam's bridge.—Caution.**—Adam's bridge is a narrow ridge of
50 sand and rocks, mostly dry, which connects Mannar island with Pamban island about $15\frac{1}{2}$ miles west-north-westward. It is mostly composed of shifting sandbanks with intricate channels between them in which the average depths vary and may be about 3 or 4 feet (0^m9 or 1^m2). During the South-west monsoon a strong current sets north-

Chart 69.

ward over Adam's bridge ; a confused sea which weakens westward as the Indian coast is approached, is generally experienced near Mannar island.

Owing to the existence of cables, vessels are warned not to anchor in an area northward of Adam's bridge, the limits of which are indicated on the chart by pecked lines.

Pamban island. — Landmarks. — Danger. — Pamban island, lying between Adam's bridge and Ramen point, the eastern extremity of the Ramnad district of Madras, about 17 miles west-north-westward, is low and sandy ; it is well planted with coconut palms towards its western end where a broad peninsula extends about 3 miles north-eastward.

There is a small but prominent building at Land's End, the south-eastern extremity of the island, and the red-roofed railway buildings at Dhanushkodi (*Lat. 9° 11' N., Long. 79° 25' E.*), about 2 miles north-westward, are also prominent. A pier for the use of steamers carrying out the ferry service between Dhanushkodi and Talaimannar, extends from the north-eastern coast abreast Dhanushkodi ; it is 720 feet (219^m5) in length, carries a double railway track, and there are depths of 11 feet (3^m4) on either side of the pier head. A white beacon is charted about one mile north-westward of the pier.

There is a large Pilgrim traffic through Dhanushkodi between March and September. The port is administered by a Port Conservator ; there is a Port Medical officer and medical supplies are available, but the hospital is at the quarantine station which is situated at Mandapam on the mainland of India, about 2 miles westward of Ramen point ; seamen are admitted to the hospital. Owing to the prevalence of malarial fever, Pamban island cannot be considered healthy.

Fresh water is laid on to the pier and limited quantities of provisions and coal can be supplied in an emergency by the South Indian Railway company.

Chuttram, on the south-western coast of the island, about 2½ miles north-westward of Dhanushkodi, stands amongst a clump of palm trees about 75 feet (22^m9) high, and is easily identified.

Rāmeswaram temple, situated in the town of that name on the eastern side of the broad peninsula and about 8½ miles north-westward of Dhanushkodi, is very conspicuous and is the first landmark raised when making Pamban pass from either northward or southward. The temple, which is 164 feet (50^m0) high, appears as a large square tower when viewed from north-eastward or south-westward and as a narrow pinnacle when viewed from south-eastward or north-westward. It is more conspicuous than Gandhamana temple, situated about one mile farther north-westward, with which it is often confused. Gandhamana temple, the top of which is 145 feet (44^m2) high, stands in a large enclosure and is entered by a gateway, 100 feet (30^m5) in height, situated on rising ground on its northern side. A large clump of trees, 107 feet (32^m6) high, stands about three-quarters of a mile eastward of Gandhamana temple and, when raising the land from northward, the clump and the temple appear like a pair of hills.

A bank on which the depths are less than 3 fathoms (5^m5) extends about 2½ miles north-eastward from the extremity of the broad peninsula, and a 6-foot (1^m8) patch lies on this bank, about one mile from the north-eastern extremity of the peninsula.

Charts 68a, 828, 70.

Chart 3581.

Pamban port. — Light. — Storm signals. — Beacon. — The port of Pamban (*Lat.* 9° 17' N., *Long.* 79° 13' E.) is situated close northward of the western extremity of Pamban island, about 6 miles westward of Rāmeswaram temple. A light is exhibited, at an elevation of 94 feet (28^m7), from a white masonry tower, 67 feet (20^m4) in height, situated on a sandhill on the north-western point of Pamban island. Storm signals are displayed from a flagstaff close to the lighthouse; the general system, *see* pages 30–32, is in force at Pamban.

10 North-east Port beacon, 18 feet (5^m5) high and painted white, stands close northward of the lighthouse.

Off-lying danger.—Buoy.—Kanthé Thuki reef, situated about 4 cables westward of Pamban lighthouse, is composed of partly-drying coral heads. There is a boat channel between this reef and the coast which is used by pilots when boarding vessels during the North-east monsoon.

Outer Fairway conical buoy, painted in black and white chequers, is moored about 3 cables north-westward of Kanthé Thuki reef and about 6½ cables west-north-westward of Pamban lighthouse.

20 **Anchorage.**—Anchorage may be obtained, in depths of from 20 to 23 feet (6^m1 to 7^m0), mud and good holding ground, with Pamban lighthouse bearing between 122° and 134°, distant about one mile.

Good anchorage, in depths of 5½ fathoms (10^m1), may also be obtained with Pamban lighthouse bearing 135°, distant about 3¼ miles.

25 **Town.**—The town of Pamban lies stretched along the north-western coast of Pamban island for about half a mile south-westward of the lighthouse; in 1951, the population was about 2,000, mainly labourers and fishermen.

The port is administered by a Conservator, and a Superintendent of Customs is stationed there. A few lighters of from 10 to 25 tons capacity are available, from which cargo is loaded and unloaded on the beach. Water can be supplied in 400-gallon casks in boats. In emergency, coal could be supplied by the South Indian Railway company.

30 **Winds.**—*See* Percentage frequency of wind direction at coast stations, page 88.

Pamban pass.—The Great Dam.—Beacons.—Buoys.—Pamban pass is the navigable channel, partly artificial, through the banks which occupy the space between the western end of Pamban island and Ramen point, about 11 cables westward; in 1942, there was a least depth of 8½ feet (2^m6) in the pass.

The pass is of great advantage to native coasting craft trading between ports on the western coast of India and those of the Bay of Bengal; it is also used by some small coasting vessels of from 200 to 800 tons and about 200 feet (61^m0) in length, but these are as large as can be safely navigated.

Ramen point is the extremity of a narrow tongue of land named Thonithorai which projects eastward from the Ramnad coast. Thonithorai temple, now in ruins, stands about 1¼ cables within the point and at about the same distance farther westward is a prominent sparse plantation of coconut palms.

50 A rocky barrier extends in an approximate straight line between the western coast of Pamban island and Ramen point; the Pamban viaduct, which carries the South India railway, is built on this barrier.

Chart 3581.

At about a quarter of a mile westward of the eastern end of the barrier is Pamban pass (*Lat. 9° 17' N., Long. 79° 12' E.*), a cutting through it which is 200 feet (61^m0) in width; a rolling lift bridge is constructed over this channel to permit vessels to pass through it. 5

On the western side of Pamban pass the barrier is named The Great Dam and consists of large masses of rock having a flat surface which were formerly portions of a causeway that extended from Pamban island to the mainland. The northern face of the dam is steep-to at low water and presents a wall-like appearance but the boulders are sufficiently separated to allow a free passage to the water at low tide. 10
At about 1½ cables eastward of Ramen point there is an opening in the rocks; it is, however, so small and has such a rush of water through it that even fishing canoes never attempt its passage. About half a cable southward of the Great Dam and parallel with it, a ridge of 15
rock and coral which partly dries, extends from Pamban pass about half-way to Ramen point.

Beacons mark the sides of Pamban pass over a distance of about 1½ cables on either side of the rolling-lift bridge and a beacon stands on the western side of Kanthé Thuki reef, about 6½ cables westward 20
of Pamban lighthouse.

A black conical buoy is moored on the eastern side of the pass, about 1½ cables northward of the rolling lift bridge.

Pilotage.—Pilotage is compulsory for merchant vessels using Pamban pass. There are several licensed pilots at Pamban who are 25
under the orders of the Port Conservator.

Pilots are stationed on the northern and southern sides of Pamban pass to look out for vessels making Pamban. There are no official signals for vessels requiring a pilot, but local craft usually display a red or a white flag. 30

The rolling-lift bridge carrying the railway across Pamban pass is under the control of the Port Conservator who will cause it to be opened if half an hour's notice be given; in an emergency, he is empowered to open it immediately.

Flag P of the International Code of Signals, displayed from the flag- 35
staff of the Port Offices at Pamban, denotes that the bridge is fully open; displayed from the northern yardarm of the flagstaff it denotes that vessels from northward only may pass through, and from the southern yardarm, that vessels from southward only may pass through.

Currents.—**Tidal streams.**—The currents set southward during 40
the North-east monsoon and northward during the South-west monsoon; their velocity is proportionate to the wind and a rate of from 5 to 6 knots is frequently attained, rendering the passage of the pass difficult at times, even for powered vessels.

Definite tidal streams are only noticeable during the months of 45
March, April and October, when they generally set through the pass for 6 hours in each direction.

The southern approaches to Pamban pass and the adjacent coasts, are described in the West Coast of India Pilot.

Charts 3581 and 68a.

Ramen point to Devipattanam.—**Coast.**—**Beacons.**—**Dangers.** 50

—Between Ramen point (*Lat. 9° 17' N., Long. 79° 11' E.*) and the town of Devipattanam, about 21 miles west-north-westward, the mainland coast of India is generally low and level; about midway

Charts 828, 70.

Charts 3581 and 68a.

along this stretch, the coast is broken by the entrance to Vaigai river, on the north-western side of which is the town of Attangarai. Devipattanam was formerly a port of some importance with a ferry service with Mannar, but since the opening of the railway to Dhanushkodi, its trade has steadily declined and is now insignificant.

Monicardu point lies just over 3 miles west-north-westward of Ramen point; about 8 cables southward of it stands a conspicuous water tower, 58 feet (17^m7) high, consisting of a red square tank on a framework structure.

North Toni beacon, painted white and 20 feet (6^m1) high, is situated on the coast about 8½ cables westward of Ramen point; Mandapam north beacon, painted white and 27 feet (8^m2) high, stands near the coast about 1½ miles west-north-westward of North Toni beacon.

Kathu Vallimuni reef, which lies close north-westward of, and parallel with, the coast for about 1¾ miles westward of Ramen point, consists of scattered heads of coral with depths of several feet between them; at the eastern end of the reef are heads which dry 2 feet (0^m6).

Vella Pertumuni reef lies close westward of Kathu Vallimuni reef, and extends in a westerly direction for a distance of about 3 miles. A narrow boat channel, with a depth of 5 feet (1^m5) in it, and marked by beacons, separates the two reefs; two beacons on shore, about 1¾ cables apart, in line bearing about 208°, mark the passage through the boat channel.

There is also a boat channel between the mainland and the above two reefs, extending westward from Ramen point for a distance of about 2½ miles; this channel is marked by beacons, the positions of which can best be seen from the chart.

Chart 68a.

A detached 3¾-fathom (6^m9) patch lies about 7¼ miles north-eastward of the mouth of Vaigai river.

Western side of Palk bay.—Coast.—Light.—Beacons.—Between Devipattanam and the low point southward of Vellar river (page 164), about 40 miles north-eastward, the western side of Palk bay is generally low and level. Tondi, a port of some commercial importance until the extension of the railway to Dhanushkodi, is situated about 17½ miles north-north-eastward of Devipattanam; its trade is now confined to native coasting craft. In 1951, the population of Tondi was about 8,800.

A light is exhibited, at an elevation of 63 feet (19^m2), from a steel mast, 52 feet (15^m8) in height, situated close southward of the Custom house at Tondi (*Lat.* 9° 45' N., *Long.* 79° 00' E.).

Two white masonry beacons 15 feet (4^m6) in height, mark the limits of the port.

Anchorage.—Anchorage may be obtained in depths of about 4½ fathoms (8^m2), mud, with Tondi light-structure bearing 295°, distant about 5 miles, but it is exposed to all except offshore winds. Small vessels may anchor nearer the town in depths of from 1¾ to 3 fathoms (3^m2 to 5^m5), stiff mud.

Coast.—Dangers.—Pasipattanam mosque stands on the coast about 5 miles north-eastward of Tondi light-structure; in 1891, less depths than are charted were reported south-eastward of the mosque, namely, 1¾ fathoms (3^m2) between 3½ and 4 miles, and 2¼ fathoms (4^m1) at 5¼ miles, from the mosque.

Charts 828, 70.

Chart 68a.

The towns of Kottaipattanam (*Lat. 9° 59' N., Long. 79° 12' E.*) and Ammapatam are situated on the coast about 17 and 21 miles, respectively, north-eastward of Tondi; the latter town, which had a population of about 4,000 in 1951, had formerly a brisk trade with Ceylon ⁵ but since the opening of the railway to Dhanushkodi its trade had steadily declined and in 1951 had practically ceased.

Tidal streams and currents.—*See* page 165.

Charts 828, 70.

CHAPTER IV

POINT CALIMERE TO GODĀVARI POINT

Chart 828.

COROMANDEL COAST.—**General remarks.**—The name Coromandel (of doubtful origin, but generally supposed to be a corruption of Cholanmandalam), is applied to the eastern coast of Madras state and also at times to the Orissa coast north-eastward of it.

All this coast is low and sandy, and exposed to a very heavy surf, the artificial harbour of Madras alone affording shelter for shipping other than small craft. Northward of Sadras, situated about 34 miles southward of Madras, the sea appears to have encroached upon the land to a considerable extent.

Currents.—Vessels making this coast should bear in mind that it is not at all unusual to experience currents setting at the rate of from one to 2 knots or more in the offing. The changes in the direction of the coastal currents in different months are described on page 26. Between Point Calimere and Madras, in 1901, currents of from one to 2 knots were experienced during the months from January to March inclusive, in depths of more than 25 fathoms (45^m7), decreasing in depths between 20 and 10 fathoms (36^m6 and 18^m3), with little or none in depths of less than 10 fathoms (18^m3), whilst close offshore the current was occasionally reversed.

Chart 71.

Point Calimere to Negapatam.—**Coast.**—**Off-lying danger.** Between Point Calimere (page 163) and the port of Negapatam, about 28 miles northward, the coast is low and fringed with groups of palmyra and casuarina trees; two dark-coloured pagodas, situated about 5 miles northward of Point Calimere (*Lat. $10^{\circ} 17' N.$, Long. $79^{\circ} 53' E.$*), are the only prominent landmarks on this stretch of coast.

Negapatam shoal, a narrow ridge about $5\frac{1}{2}$ miles in length, with depths of from $3\frac{1}{2}$ to 5 fathoms (5^m9 to 9^m1) over it, lies parallel with the coast about 4 miles offshore and is steep-to at its northern end, which lies about 7 miles south-eastward of Negapatam.

This stretch of coast should not be approached within depths of from 7 to 8 fathoms (12^m8 to 14^m6), and, in the vicinity of Negapatam shoal, vessels should not proceed into depths of less than 10 fathoms (18^m3).

Chart 71, plan of Negapatam and Nagore anchorages.

Negapatam.—**Light.**—**Storm signals.**—Negapatam, the principal port of the Tanjore district of Madras state, is situated at the mouth of the Kaduveiyaru river. Nagore, about 3 miles northward of Negapatam, stands on the southern bank of the Vettar river about half a mile within its entrance.

Charts 71, 828, 70.

Chart 71, plan of Negapatam and Nagore anchorages.

The limits of the port of Negapatam are defined by boundary pillars, situated about one mile southward, and half a mile northward, respectively, of the mouth of the Kaduveiyaru river. The northern limit of the port of Nagore is defined by the northern bank of the Vettar river; southward, the port joins that of Negapatam. 5

A light is exhibited, at an elevation of 80 feet (24^m4), from a white masonry tower, 83 feet (25^m3) in height, situated about one cable westward of the entrance to the Kaduveiyaru river.

Storm signals are displayed from the lighthouse; the extended 10 system of these signals, *see* pages 33 and 34, is in use at Negapatam.

Prominent landmarks at Negapatam are:—The lighthouse; a tall church spire, situated about 2 cables north-north-westward of the lighthouse; and two chimneys at the workshops of the South Indian railway, situated about 4 cables south-westward of the light- 15 house.

Nagore is remarkable for its mosque and minaret, situated about one mile west-south-westward of the mouth of the Vettar river; the main tower of the minaret is 148 feet (45^m1) in height, and is visible from seaward before raising the adjacent coast. 20

Dangers.—Several sandy shoals with depths of from 4½ to 5 fathoms (8^m2 to 9^m1) over them, lie about 2½ miles offshore between Negapatam and Nagore.

Anchorage. — **Buoy.** — **Signal station.** — The anchorages off Negapatam and Nagore are open to all but westerly winds. In the 25 former anchorage, the bottom is sand and mud, good holding ground, and the depths shoal gradually towards the coast. Vessels anchor according to their draught and the state of the weather; in fine weather, a good berth is in depths of from 4½ to 6 fathoms (7^m8 to 11^m0), with the lighthouse bearing between 281° and 225°, and Nagore 30 minaret bearing between 315° and 322°, but it is an uncomfortable anchorage as vessels nearly always lie athwart wind and sea. In heavy weather, a short and broken sea arises, and during the North-east monsoon it is inadvisable to anchor in depths of less than 5 fathoms (9^m1). 35

The anchorage off Nagore is in depths of from 3½ to 4½ fathoms (6^m4 to 8^m2), from 5 to 7 cables offshore eastward of the minaret or in greater depths farther seaward. The holding ground is good.

A spherical buoy, painted green and surmounted by a staff and sphere, is moored about 1½ miles east-south-eastward of the lighthouse 40 as a guide to the anchorage for vessels of moderate draught.

A signal station (*Lat.* 10° 46' N., *Long.* 79° 51' E.) with which vessels at the anchorage off Negapatam can communicate using the International Code of Signals by day, and at night by the Morse code, is situated on the roof of the Port office building, close southward of the 45 lighthouse.

Current.—The current off Negapatam generally sets with the wind, and its direction and force appear to depend on the wind.

Chart 828.

Directions.—Vessels bound for Negapatam from southward should 50 keep in depths of more than 10 fathoms (18^m3) when near Point Pedro shoal (page 159) and should not close the coast between Point Calimere and Negapatam within that depth until the conspicuous church spire at the latter place bears less than 309°.

Charts 71, 828, 70.

Chart 71, plan of Negapatam and Nagore anchorages.

Harbour.—Port facilities.—The port of Negapatam comprises the mouth of the Kaduveiyaru river, across which there is a bar. Regular trading vessels use the port, anchor and work cargo in the open roadstead, using native lighters. These lighters, which must have a draught of less than 4 feet (1^m2) to cross the difficult bar, discharge at quays on the river banks. There are two framework groynes at the mouth of the river ; the quays for lighters extend southward from the northern groyne and from the western bank of the river. About December, a sandspit forms, and gradually increases until early in July when it nearly blocks the river mouth.

The sea breaks over the bar in nearly all weathers. It can be crossed by native boats at half tide but is dangerous to any but an efficiently manned surf boat. Boats are not permitted to cross the bar after dark.

The port is subject to cyclonic storms which affect the work of lighters ; these storms, as well as the North-east monsoon, raise heavy breakers on the bar.

A small stock of Bengal coal is available ; it is supplied to vessels from lighters at a rate of about 20 tons per hour.

A small stock of fuel oils is maintained.

A good supply of water is obtainable.

There are about 100 lighters with capacity of from 10 to 40 tons in the port, and there are two 3-ton cranes on the lighter quays.

There is regular sea communication with Madras and other Indian ports and also with Ceylon and South-east Asia.

Town.—Trade.—Negapatam was one of the earliest Portuguese settlements on the east coast of India ; in 1941, the population was 52,934. The port is administered by a Port Conservator.

The principal exports are ground nuts, rice, tobacco leaf and cigars ; and the chief imports are betel nuts, sugar and timber.

In 1948–49, exports amounted to 7,109 tons and imports to 3,190 tons.

Nagore.—The population of Nagore is mainly Mohammedan ; the Kandiri festival, one of the greatest Mohammedan festivals in Southern India, is celebrated here annually and attracts many pilgrims. The Vettar river is about one cable wide abreast Nagore, but it is blocked by islets and shoals and its entrance is obstructed by a bar, similar to that of Kaduveiyaru river, with depths of about 4 feet (1^m2) over it.

Chart 71.

Nagore to Kaveripattanam.—Coast.—Between the mouth of the Vettar river (*Lat. 10° 50' N., Long. 79° 51' E.*) and the village of Kaveripattanam (Cauverypatam), about 19 miles northward, the coast continues very low and flat. Puravadalyanār and Tirumalar-ājanār rivers enter the sea between the mouth of the Vettar river and that of the Arasalār river, about 5 miles northward ; the mouths of the two former rivers are obstructed by bars, and can only be navigated after heavy rains have swollen their streams when cargo may be landed in flat-bottomed boats.

Karikal. — Light. — Signal station. — Bar signal. — The small French enclave of Karikal lies on the northern side of the Vettar river, its coast extending from close northward of the entrance to that river for about 9 miles northward ; in 1951, the population of the enclave was about 60,000.

Charts 828, 70.

Chart 71.

The port of Karikal is situated on the northern bank of the Arasalār river, about one mile within the entrance. Vessels trading with the port anchor in the open anchorage off the river mouth and use native boats for handling cargo. Landing should not be attempted with ship's boats. The working of cargo is carried on with little difficulty in Arasalār river; the bar at its mouth, which has a depth of 8 feet (2^m4) over it at high water, springs, is marked by rollers, and is very dangerous in October, November and December. 5

A light is exhibited, at an elevation of 59 feet (18^m0), from a white stone tower, 56 feet (17^m1) in height, situated close within the northern entrance point of Arasalār river (*Lat. 10° 55' N., Long. 79° 51' E.*). 10

There is a signal station at the lighthouse, with a flagstaff which usually displays the French flag, close to it; communication can be effected by means of the International Code of Signals. 15

A blue flag displayed at the flagstaff indicates that there is a heavy sea on the bar and that communication with the port is prohibited.

Anchorage.—Anchorage may be obtained, in depths of from 5 to 6 fathoms (9^m1 to 11^m0), mud and sand, with Karikal lighthouse bearing 264°. This is reported to be the best anchorage on this coast. 20 Vessels working cargo should anchor in suitable depths with the lighthouse bearing 285°.

Port facilities.—The harbour is administered by a Port officer who is also the Customs officer and has charge of the native boat service; the only boats used here are surf boats of from 20 to 25 tons capacity, known locally as "chelingues". 25

Only limited quantities of provisions are available.

There is a hospital to which seamen are admitted.

There was formerly a considerable import and export trade at the port but it has greatly declined since 1942, and in 1951 it was reported that sea-borne trade had practically ceased at Karikal. 30

There is occasional sea communication with Madras and other Indian ports.

Current.—The current is generally inappreciable close inshore but sets strongly in the offing; it sets northward from February to July and southward from October to December. 35

Winds.—For winds on the Coromandel coast, *see* page 60, and Percentage frequency of wind direction at coast stations, page 88.

Tranquebar.—**Anchorage.**—Tranquebar is situated on the north bank of a river which is navigable only by native boats, about 6½ miles northward of Karikal lighthouse. The old fort of Dansborg, some large white houses, and a lookout tower indicate its position from the offing. A small grove of casuarina trees flanks the southern side of the town. Protective groynes, which should not be approached too closely in boats, extend about one cable seaward. 40 45

During the North-east monsoon there are depths of about 6 feet (1^m8) at high water over the river bar.

Anchorage may be obtained, in depths of from 5½ to 6 fathoms (10^m1 to 11^m0), about three-quarters of a mile offshore, with the fort bearing about 281°. 50

The town, which, in 1931, had a population of 12,796, is one of the healthiest places in the district; the European bungalows are mostly situated within Dansborg fort but the majority of the natives reside in Poraiyār, about one mile inland.

Chart 71.

Coast.—There are two pagodas in Kaveripattanam, about 7 miles northward of Tranquebar. Northward of this village the coast commences to rise slightly.

- 5 **Tirumullaivasāl anchorage.**—Tirumullaivasāl (*Lat. 11° 15' N. Long. 79° 50' E.*) is a small town in which is a pagoda, situated on the north bank, near the mouth of one of the many branches of the Cauveri river, about 6 miles northward of Kaveripattanam.

A flagstaff, 58 feet (17^m7) in height, stands just northward of the Custom-house, a low, tiled building, and is the only landmark on this part of the coast; when approaching from southward the flagstaff can be seen over the tops of the trees.

Two boundary pillars on the coast mark the northern and southern port limits, and anchorage may be obtained, in depths of 5 or 6 fathoms (9^m1 or 11^m0), with the flagstaff bearing between 270° and 247°.

The anchorage should be approached with caution, as the depths within 5 fathoms (9^m1) decrease rapidly.

- Coast.**—Coleroon river flows into the sea by two mouths, situated about 10 and 13½ miles, respectively, northward of Tirumullaivasāl. See page 5. Coleroon point is the northern end of a long sandy spit which extends northward between the two mouths; it has no vegetation on it and is difficult to distinguish from seaward.

The four Chidambaram pagodas, situated about 7 miles westward of the southern mouth of the Coleroon river, are remarkable, and can be seen distinctly over the trees abreast of the river.

Between Coleroon point and the mainland, about 1½ miles westward, are some sandbanks which dry. About 3 miles north-westward of the point the Vellār river flows into the sea.

- Off-lying dangers.**—A shoal, extending about 1½ miles in a direction roughly parallel with the coast, was reported, in 1923, to lie about 1½ miles offshore about 7 miles northward of Tirumullaivasāl.

A shoal, on which the sea breaks heavily during the strength of the North-east monsoon, was reported, in 1921, to extend about 2 miles offshore between the southern mouth of the Coleroon river and a position north-eastward of Coleroon point, and to have depths of from 3 to 4 fathoms (5^m5 to 7^m3) over its outer edge, with depths of 11 and 12 fathoms (20^m1 and 21^m9) inside it.

Vessels should not approach this part of the coast within a depth of 10 fathoms (18^m3) by day, or within a distance of 4 miles by night.

- 40 **Porto Novo.—Storm signals.**—Porto Novo is situated on the northern bank of the Vellār river about one mile within the entrance. The town was originally a Portuguese settlement and for many years was a flourishing port with a large export of ground nuts. Since the extension of the railway to Cuddalore (page 181) in 1934, the ground nut traffic has shifted to the latter port and the trade of Porto Novo is now confined to native coasting craft and of little importance. In 1931, the population of Porto Novo was 13,762. The Vellār river, see page 6, has depths of 3 feet (0^m9) on the bar across its mouth in summer, and 7 feet (2^m1) during winter after the floods.

50 The northern and southern limits of the port are marked by two white boundary pillars, situated near the coast about half a mile northward and southward, respectively, of the river entrance.

A white flagstaff from which storm signals are displayed, stands on the northern bank of Vellār river about a quarter of a mile within the

Chart 71.

entrance. The extended system of storm signals, *see* pages 33 and 34, is in use at Porto Novo.

Anchorage.—Directions.—From about mid-October until nearly the end of December, vessels should anchor about 3 miles offshore in depths of 9 fathoms (16^m5), but from the month of January onwards, during the South-west monsoon and in fine weather, anchorage may be taken up closer inshore according to draught. During the first burst of the North-east monsoon, native craft avoid this port on account of Coleroon shoal being leeward of the anchorage.

Coast.—Between the mouth of the Vellār river (*Lat.* $11^{\circ} 30' N.$, *Long.* $79^{\circ} 46' E.$) and Cuddalore, about 13 miles northward, the coast is low with occasional sandhills which, from an offing, appear like islets.

Chart 71, plan of Cuddalore.

Cuddalore. — Light. — Signal station. — Cuddalore the principal port and capital of South Arcot district, is situated on the Uppanār, a backwater formed by the confluent estuaries of the Gadilam and Paravanār rivers, both of which are liable to heavy floods in the rainy season. Cuddalore Old town, which shows up well from northward, especially the buildings eastward, is situated on the Paravanār river; Cuddalore New town is situated on the Gadilam river, about one mile northward of the old town. The entrance to the Gadilam river is only open for a few weeks in the year after floods, usually in October or November.

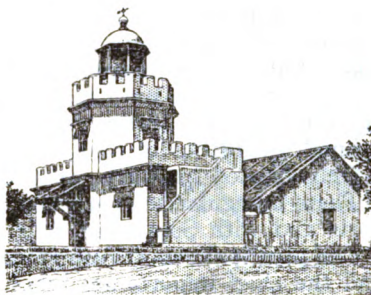
A light is exhibited, at an elevation of 65 feet (19^m8), from a white tower surmounting a white square house, 34 feet (10^m4) in height, situated on a sand hill close within the coast and abreast Cuddalore Old town. A white flagstaff, 102 feet (31^m1) high, stands close northward of the lighthouse; both the lighthouse and the flagstaff are prominent marks.

There is a signal station at the lighthouse; signals in the Morse code can be transmitted at night through the signal station.

The limits of the port of Cuddalore are defined by small white boundary pillars, situated about $1\frac{3}{4}$ miles south-south-westward, and $1\frac{1}{2}$ miles north-north-eastward, of Cuddalore lighthouse.

Port entrance. — Bar. — Leading lights. — Tidal signals. — The entrance to the port lies over a bar at the mouth of the Paravanār river. This entrance is usually open throughout the year and has depths of about 4 feet (1^m2) in summer and 7 feet (2^m1) in winter after the floods. The entrance channel, which is maintained by constant dredging, is continually shifting its position, moving northward during the South-west monsoon and southward during the North-east monsoon; its tendency to move northward is being checked by periodical dredging southward of the bar.

Leading lights for the channel across the bar are occasionally



Cuddalore lighthouse.

Chart 71, plan of Cuddalore.

exhibited on the northern side of the entrance, at elevations of 20 and 24 feet (6^m1 and 7^m3), respectively, from white iron columns; the front column is surmounted by a square topmark and the rear column 5 by a diamond topmark. These light-beacons in line, bearing about 296°, lead over the bar; the light-beacons are liable to be moved to meet changes in the channel.

A red ball is displayed by day and a *red* light exhibited at night, both at an elevation of 26 feet (7^m9), when passage across the bar is 10 closed to boats.

Obstruction.—Buoy.—An obstruction over which there is a depth of 5 fathoms (9^m1), is situated about 1½ miles south-south-eastward of Cuddalore lighthouse; it is marked on its northern side by a green conical buoy.

15 **Anchorage.**—The best anchorage is in a depth of about 6 fathoms (11^m0), with Cuddalore lighthouse (*Lat. 11° 43' N., Long. 79° 47' E.*) bearing between 295° and 310°, from three-quarters of a mile to one mile offshore.

Storm signals.—The extended system of storm signals, *see* 20 pages 33 and 34 is in use at Cuddalore.

Town.—Port facilities.—The town, which is reported to be healthy, had in 1931 a population of 59,057. There is an Anglican and a Roman Catholic church in Cuddalore Old town which also contains the Port office and the Customs house. In Cuddalore New 25 town (*Lat. 11° 44' N., Long. 79° 47' E.*), situated on a large open plain and noted for its ancient Siva temple, are the principal public offices and bungalows. There is a Government hospital which admits seamen.

Cargo is handled by lighters between vessels at the anchorage, and 30 wharves on the western side of the Uppanār abreast the Old town; about 120 lighters of from 12 to 16 tons capacity are available and there are three one-ton fixed cranes on the wharves. There is a small dry dock, 95 feet (29^m0) in length, at the port.

Small quantities of coal and liquid fuel are maintained.

35 Only limited quantities of provisions and water are available.

There is regular sea communication with Madras and other Indian ports and with South-east Asia.

The principal exports are ground nuts, cotton piece goods and oils; and the chief imports are betel nuts, coal, grains and timber.

40 In 1948–49, exports amounted to 5,241 tons and imports to 117,091 tons.

Chart 71.

Coast.—From the entrance to the port of Cuddalore, the coast trends north-north-eastward for about 14 miles to Pondichéry (Pondicherry) lighthouse. 45

Chart 71, plan of Pondicherry anchorage.

Pondichéry.—Lights.—Pondichéry is the headquarters of all French settlements in India and is the seat of the Governor-General of those settlements. The land from 3 to 5 miles north-westward and 50 northward of the town, is from 150 to 240 feet (45^m7 to 73^m2) high, and helps to identify the locality; the cathedral, situated about 2 cables southward of the lighthouse, has two square towers with a cupola and is prominent. A tall chimney, situated about 1½ miles west-south-westward of the lighthouse, is also a good mark.

Chart 71, plan of Pondichéri anchorage.

An iron pier on screw piles projects about 1,105 feet (336^m8) from the beach about half a cable south-eastward of the lighthouse.

A light is exhibited, at an elevation of 88 feet (26^m8), from a masonry tower, 75 feet (22^m9) in height, situated in a square close within the 5
coast.

A light is exhibited, at an elevation of 36 feet (11^m0), from a mast on a hut, situated close within the pier head.

A light is exhibited on the dome of the church of Saint Francois, situated about 6 cables northward of the lighthouse. 10

Signal stations.—Signals.—Both the town flagstaff and a flagstaff at the Port office, the latter situated about half a cable south-westward of the lighthouse, are signal stations with which vessels may communicate using the International Code of Signals. At night, in cases of emergency, signals may be sent by lamp, using the Morse code. 15

A blue flag displayed at the Port flagstaff by day, or at night, a green light exhibited below the light on the pier head at an elevation of 26 feet (7^m9), indicates that, in consequence of the surf, communication with the shore is prohibited; a blue flag displayed on the pier, indicates that landing at the pier is prohibited and communication with the shore 20
is then confined to surf boats.

The signal from vessels requesting a boat is answered by a blue pendant displayed at the Port office flagstaff (*Lat.* 11° 56' N., *Long.* 79° 51' E.).

Anchorage.—Leading lights.—Danger area.—The usual anchor- 25
age is in depths of from 6 to 7 fathoms (11^m0 to 12^m8), with the lighthouse bearing 282°, distant one mile, but from October to December, when bad weather may be expected, it is desirable to anchor about half a mile farther out, in depths of from 8 to 9 fathoms (14^m6 to 16^m5); a long scope of cable is recommended, and precautions against bad 30
weather should always be taken. The holding ground is not very good.

Leading lights for the use of vessels anchoring at night have been established. The front light is situated close within the coast about half a mile southward of the root of the pier; the rear light is situated about 1½ cables west-south-westward of the front light. These lights 35
in line bearing 243°, lead to a night anchorage about 3½ cables east-south-eastward of the pierhead.

Vessels arriving at night should anchor on the leading line with the light on the pierhead bearing 289°.

A rifle range is situated southward of the town. The northern limit 40
of the danger area is indicated by a pecked line on the chart. When firing is taking place red flags are displayed on the beach, during which time vessels are forbidden to approach within 3 miles of the coast.

Port regulations.—The local signals and the regulations of the 45
port are delivered to merchant vessels immediately on arrival, and the directions therein should be strictly complied with.

In case of a vessel not answering signals made to her from the port, guns will be fired to attract her attention.

Quarantine.—The quarantine regulations are somewhat strict for 50
vessels direct to or from Europe, and no communication is allowed with the shore, or with any vessel or boat in the roadstead, until pratique has been granted, unless the vessel arriving is in danger, when other vessels are bound to send assistance, whether pratique has been 55
granted or not.

Charts 71, 828, 70.

Chart 71, plan of Pondicherry anchorage.

Winds.—The North-east monsoon blows from October to the end of January, and renders it very difficult to work cargo owing to rough seas. For the rest of the year the wind is generally off the land, from 5 westward, in the morning, but there is usually a stiff breeze from south-eastward in the afternoon, which makes the sea very choppy.

Town.—Port facilities.—The town, which in 1941 had a population of 58,101, is divided into two parts by a canal running parallel with the coast; the seaward or eastern part has numerous fine public 10 buildings and hotels fronted by a broad boulevard, close within the beach, which give the town an imposing and pleasing appearance. British Consular officers reside in the town.

There is a good hospital to which seamen are admitted.

There are about 50 small lighters available for handling cargo, each 15 with a capacity of about $2\frac{1}{2}$ tons; lighters load and unload alongside the pier which is connected with the railway system and on which are four cranes, the largest of which has a lifting capacity of 3 tons. Cargo is handled by these cranes direct between the lighters and railway trucks.

Landing by ships' boats should not be attempted on the beach, and 20 only in fine weather at the pier.

Fresh provisions are available; fresh water is scarce.

The principal exports are ground nuts, bone meal, cotton-piece goods, textiles and pottery; the chief imports are raw cotton, electric goods, sugar, wines and spirits, perfumery and areca nuts.

25 There is regular sea communication with Madras and other Indian ports.

Chart 71.

Pondichéry to Mahabalipur. — Coast. — Beacon. — Between Pondichéry and the mouth of the Pālār river (*Lat. 12° 28' N., Long. 30 80° 10' E.*), about 38 miles north-north-eastward, the coast is low and sandy except for the hills from 3 to 5 miles north-westward and northward of Pondichéry (page 182), and some other hills, from 240 to 650 feet (73^m2 to 198^m1) high, situated about 28 miles northward of Pondichéry and between 5 and 16 miles inland.

35 The ruins of Ālamparai (Allamparwa) fort stand on the northern entrance point of the outlet of a large lagoon named Kaliveli, about 22 miles north-north-eastward of Pondichéry; a thick grove of casuarina trees on the northern side of the fort, is dark and prominent. The outlet of the lagoon is obstructed by a bar at the entrance.

40 A dense wood of palmyra trees is situated behind the coastal sand-hills, about 9 miles north-north-westward of Ālamparai fort, and Pālār beacon, a pole 40 feet (12^m2) in height, stands on the coast about $4\frac{1}{2}$ miles north-north-eastward of this wood and about $1\frac{1}{2}$ miles south-south-westward of the mouth of Pālār river.

45 *Charts 71, 575.*

The Pālār river is a considerable stream which drains a large tract of country and receives many tributaries, but, like other rivers on this coast, it has a bar which completely closes the entrance in the dry season. A plantation of tall coconut palms stands on the northern 50 side of the entrance.

Breakers extend about 3 cables from the entrance to the river, and a spit, with depths of $2\frac{3}{4}$ fathoms (5^m0) over it, extends about one mile seaward of the entrance.

The village of Sadras is situated about 3 miles northward of the

Charts 828, 70.

Charts 71, 575.

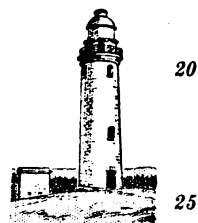
mouth of the Pālār river ; being low, the village is almost completely hidden from seaward by trees, but there is a ruined brick fort on the coast abreast the village which is clear of trees.

Sadras hills, the most prominent elevations on this part of the coast, lie from 8 to 9 miles west-north-westward of Sadras fort. The highest summit of this range has an elevation of 650 feet (198^m1), and close to it is Finger peak, 500 feet (152^m4) high, which is readily identified by a temple on its summit. Tirumani, about 5 miles west-north-westward, and Pattaravakkam (Pataravakam), about 6 miles north-north-westward, of Finger peak, with lower hills grouped around them, are also prominent.

Mahabalipur is a rocky point, about 6 miles north-north-eastward of Sadras fort, on which are several pagodas ; one of these pagodas is situated on the extremity of the point and is visible from seaward.

Light.—Danger.—Mahabalipur light is exhibited, at an elevation of 137 feet (41^m8), from a masonry tower, 84 feet (25^m6) in height, situated on a prominent rock about half a mile within the extremity of the point.

Tripalur reef is a rocky ledge extending about three-quarters of a mile eastward from the coast abreast Mahabalipur lighthouse ; the inshore edge of this ledge is awash and over the outer end is a depth of 4½ fathoms (8^m2) with depths of 6½ fathoms (11^m9) close to.



Mahabalipur to Covelong point. — Coast. — Dangers. — Anchorage.—From Mahabalipur lighthouse, the coast trends north-north-eastward for about 11 miles to Covelong point ; the village of Covelong is situated close within the point on the southern side of the estuary of a river which enters the sea about three-quarters of a mile northward of Covelong point. Tirupporūr, a hill on the summit of which is a temple, lies about 7 miles northward of Mahabalipur lighthouse and about 3 miles inland.

The stretch of coast between Sadras fort (*Lat. 12° 32' N., Long. 80° 10' E.*) and Covelong point should not be approached within a depth of 15 fathoms (27^m4), as there are several off-lying rocky patches, especially northward of Tripalur reef.

Rockingham patches, a group of shoal patches lying as much as 1½ miles offshore about 4½ miles north-north-eastward of Mahabalipur lighthouse, have a least depth of 2½ fathoms (4^m6), which depth lies on the edge of uneven ground over which the depths are from 4 to 5 fathoms (7^m3 to 9^m1) ; there are depths of 5½ fathoms (10^m1) between this patch and the coast. A rocky head with a depth of 3½ fathoms (6^m9) over it, lies about 1½ miles south-south-westward of the shoalest patch and a similar head lies about three-quarters of a mile north-eastward of it.

Rocks, awash, extend about 3 cables north-eastward from Covelong point, and, during the South-west monsoon, landing may be effected near them.

There is open anchorage in depths of about 7 fathoms (12^m8), with Covelong village bearing 270°, distant about one mile.

Covelong point to Madras harbour. — Coast. — Off-lying shoal.—Between Covelong point and Madras harbour, about 18 miles northward, the coast is low throughout.

Charts 828, 70.

Charts 71, 575.

Ottivākkam, a hill about $8\frac{1}{2}$ miles westward of Covelong point, is sharp and is a moderately good mark ; it is near the southern end of a low range of hills which runs parallel with the coast. Perumbākkam, a hill about 7 miles north-westward of Covelong point, is also a fairly good mark.

Pallāvaram, a double-peaked hill about 11 miles northward of Ottivākkam, with a temple on a summit, 499 feet (152^m1) high, is a good landmark. St. Thomas' mount, about $2\frac{1}{2}$ miles farther north-eastward, is crowned with white buildings and is also a good mark.

In 1937, a shoal with a depth of $5\frac{1}{2}$ fathoms (10^m1) over it, which has not been examined, was reported to lie about $13\frac{1}{2}$ miles northward of Covelong point and about $1\frac{1}{2}$ miles offshore.

Current.—The following details of the currents prevalent off the Coromandel coast apply particularly to the vicinity of Madras. In January, the current sets south-westward or northward at a rate of from one to $1\frac{1}{2}$ knots, but is irregular ; in February, northward, parallel with the coast, $1\frac{1}{2}$ knots ; in March, April, and May, northward, from one to 3 knots, but in May, from one to 2 knots ; in June, variable, but sometimes southward, and weak ; in July and August, south-westward or against the wind, from 2 to 3 knots at times ; in September, south and south-south-west, strong ; in October, southerly along the coast, strong ; in November and December, south-westerly and southerly along the coast.

In July and August, by keeping inshore, vessels have made good passages from north to south.

Chart 575, plan of Madras roadstead.

MADRAS.—Light.—Madras, the capital and seat of government of Madras state, is the principal harbour on the Coromandel coast and the third largest port in India ; it is situated close to the sea on a low and sandy coast exposed to a heavy surf. Including a number of suburban tracts and villages, the city extends northward along the coast for about 10 miles from the mouth of the Adyar river (*Lat. $13^{\circ} 01' N.$, Long. $80^{\circ} 16' E.$*), situated about $13\frac{1}{2}$ miles northward of Covelong point. The Cooum, a small and sluggish river, flows through the city and enters the sea about $3\frac{1}{2}$ miles northward of the mouth of the Adyar river and close southward of Fort Saint George ; its mouth is closed during the hot season. The harbour, which is entirely artificial, fronts the centre of the city about one mile northward of Fort Saint George ; the coast southward of the harbour is advancing seaward, whilst northward of the harbour, except where protected by stones, it is receding.

Madras light is exhibited, at an elevation of 166 feet (50^m6), from the main tower of the law courts, an octagonal tower of brick and stone, 175 feet (53^m3) in height, situated on the esplanade about $2\frac{1}{2}$ cables northward of Fort Saint George.

Charts 71, 575.

Aspect.—From seaward, the land presents a low, sandy coast, studded with casuarina trees northward and southward with numerous prominent buildings at the centre. The following are good landmarks :—A church spire, situated about $3\frac{1}{4}$ miles southward of Madras lighthouse ; the masts of a radio station, 264 feet (80^m5) in height, close northward of Fort Saint George ; a grey tower, about 170 feet

Charts 71, 575.

(51^m8) in height, about 1½ miles north-westward of Madras lighthouse ; and the masts, 100 feet (30^m5) in height, of a radio station situated about 2 miles northward of Madras lighthouse.

Chart 575, plan of Madras roadstead.

Harbour.—Depths.—The harbour is formed by two breakwaters. The southern breakwater shelters the harbour on the southern and eastern sides, and its extension northward of the entrance is known as the Sheltering arm.

At the south-eastern corner of the southern breakwater a masonry 10 arm extends about one cable in an east-south-easterly direction which serves as a sandscreen.

The entrance, which lies between the outer end of the northern breakwater and the end of a short arm which extends north-westward from the root of the Sheltering arm, carries a depth of 34 feet (10^m4). 15 The harbour had, in 1939, a least depth of 31 feet (9^m4) over the greater part of it. Vessels with a draught of 30 feet (9^m1) can enter the harbour at all states of the tide. There is a deep-water quay on the southern side of the northern breakwater.

A masonry spur for the use of tank vessels, extends a short distance 20 northward from the outer end of the northern breakwater.

Near the south-western corner of the harbour is the entrance to a boat basin which leads into a timber pond.

Lights.—A light is exhibited, at an elevation of 64 feet (19^m5), from a mast, about 1½ miles north-north-eastward of the main light- 25 tower.

A light (*Lat. 13° 06' N., Long. 80° 18' E.*) is exhibited, at an elevation of 35 feet (10^m7), from a red and white circular stone column, 19 feet (5^m8) in height, on the head of the Sheltering arm.

A light is exhibited, at an elevation of 23 feet (7^m0), from an iron 30 framework tower, 11 feet (3^m4) in height, on the eastern side of the entrance to the harbour.

A light is exhibited, at an elevation of 23 feet (7^m0), from a concrete hut, 11 feet (3^m4) in height, on the western side of the entrance to the harbour. 35

Regulations.—Signals.—Only one vessel may leave or enter the harbour at a time. Vessels about to leave display flag N of the International Code of Signals at the fore ; vessels about to enter display flag F of the International Code of Signals at the fore. Neither of these signals should be displayed until the pilot is on board. 40

A ball displayed at the masthead of the flagstaff at the Harbour office, situated about 6½ cables north-north-eastward of Madras lighthouse, indicates that a vessel in the harbour is getting under way, or is under way. Vessels approaching the port should remain clear of the breakwater head, giving sea room to the outgoing vessel, until 45 such time as the pilot assumes control.

For the system of signals in use in the Port of Madras see “ Regulations for the Port of Madras,” issued by the Harbour Office.

No ballast may be thrown overboard off Madras in a depth of less than 12 fathoms (21^m9). 50

Pilotage.—Pilots.—No merchant vessel is allowed to enter or leave Madras harbour without a pilot on board, unless authority to do so has been given in writing by the Conservator of the port.

Vessels are taken in or out of harbour at any time of the day or night. 55

Charts 575, 828, 70.

Chart 575, plan of Madras roadstead.

Between the hours of 0600 and 1800 vessels arriving off Madras will find a pilot seaward of the harbour entrance. A strong and efficient pilot ladder, fitted with side hand ropes, must be provided, 5 otherwise the pilot will not board.

The best position to pick up a pilot is from a half to one mile seaward of the lighthouse (*Lat. 13° 06' N., Long. 80° 18' E.*) on the head of the Sheltering arm according to the weather. Masters of vessels are warned not to approach so close that ample room is not left for 10 the pilot to manœuvre the vessel for entering.

Between the hours of 1800 and 0600 a pilot will not proceed out to meet an incoming vessel unless such vessel makes the recognised signal for a pilot, which should be made in plenty of time and continued until answered by the Port signal station. When a signal for 15 a pilot has been seen it will be answered by a *white* light at the head of the Port signal station flagstaff. Vessels intending to enter the harbour at night are recommended to notify their agents by radio, so that a pilot may be awaiting their arrival; but this does not relieve them of the necessity of making the customary signal for a pilot.

20 **Port limits.**—The northern and southern limits of the port are each marked by an obelisk, and the eastern limit extends to a depth of 10 fathoms (18^m3).

Anchorage.—Madras roadstead is open, except to offshore winds; there is generally a swell from seaward, causing vessels in the roadstead 25 to labour or roll considerably.

The best anchorage is north-eastward of the harbour, in depths of 9 or 10 fathoms (16^m5 or 18^m3).

The holding ground is good, with a mud bottom, but in many places the bottom is stiff mud from which it is difficult to extricate the anchors.

30 At night, vessels should not approach into depths of less than 9½ fathoms (17^m4). A second anchor should be ready for letting go and all anchors should be buoyed.

Prohibited anchorage.—Anchorage is prohibited in any part of Madras roadstead with the main lighthouse bearing more than 270°, 35 in order to prevent injury to the submarine telegraph cable.

Explosives anchorage.—Vessels carrying explosives which are of such a nature that they are not permitted to enter the harbour, must anchor in the explosives anchorage northward of the harbour entrance.

40 **Harbour moorings.**—**Quays.**—Vessels up to 700 feet (213^m4) in length and with a draught of 31 feet (9^m4) can be accommodated in the harbour. There are fixed moorings available for eight large vessels.

There are nine berths available alongside the quays, seven of which are for general cargo and two for coal and liquid fuel as follows:—

45 West quay I. For all classes of cargo. Depth alongside, 27 feet (8^m2).

West quay II. For all classes of cargo. Depth alongside, 31 feet (9^m4).

50 West quay Centre berth. For all classes of cargo. Depth alongside 30 feet (9^m1).

West quay III. For all classes of cargo. Depth alongside, 31 feet (9^m4).

West quay IV. For all classes of cargo. Depth alongside, 29 feet (8^m8).

Charts 575, 828, 70.

Chart 575, plan of Madras roadstead.

South quay I. Mail and passenger facilities. Depth alongside 30 feet (9^m1).

South quay II. Mail, passenger and cargo facilities. Depth alongside 28 feet (8^m5).

East quay. Coal and assembled locomotives. Depth alongside 26 feet (7^m9).

North quay. For coal, general cargo and fuel oil. Depth alongside 28 feet (8^m5).

All quays are connected to the general railway system and, with the exception of East quay and North quay, are provided with all facilities for handling and storing goods of all description.

Surf.—The surf of Madras (*Lat.* 13° 05' N., *Long.* 80° 16' E.), northward and southward of the harbour, breaks at 300 feet (91^m4) from the beach in fine, but at 450 feet (137^m2), in squally weather. During gales from eastward it is reported to break at a distance of 1,000 feet (304^m8) from the beach.

There are two lines of surf between which it is possible for a boat to remain without crossing either; the outer of these, or male surf, is the most formidable. With the wind offshore the surf is often very high, but then there is only one slow, heavy roller. In ordinary weather the surf wave is from 2 to 4 feet (0^m6 to 1^m2) in height, in rough weather 6 feet (1^m8), and during a gale from 12 to 14 feet (3^m7 to 4^m3).

Storm and weather signals.—The extended system is used at Madras, *see* pages 30-34.

On the warning signal being displayed, Masters of vessels at anchor within the limits of the ports are required to attend to the following directions:—

- (a) Not to be absent from their respective vessels between sunset and sunrise.
- (b) To keep their respective vessels prepared in every respect to proceed to sea at short notice.
- (c) To proceed to sea without waiting for instructions to do so should they deem such a course prudent.

On the danger signal being displayed, the Master of each vessel will take such measures for securing the safety of his vessel as he may consider requisite; no further instructions on that point will be furnished by the port authorities.

Masters of vessels must use their own discretion whether to remain in the harbour or proceed to sea in cyclonic weather. During the cyclone of 22nd November, 1916, vessels remained inside the harbour with perfect safety.

Cyclones.—Cyclones at Madras usually commence with the wind between north-north-west and north-north-east. The wind direction changes eastward if the port is in the right-hand semicircle of the storm (*see* standard article on tropical revolving storms, page xxxiv), and westward if the port is in the left-hand semicircle.

From the middle of April to the middle of December, a sailing vessel should anchor well out, if she does not enter the harbour, and to be ready to proceed to sea to gain an offing before the wind shifts to north-east and east, when it would be impossible to get away. If a vessel proceeds to sea on the approach of a gale little danger is to be apprehended, but vessels remaining at anchor are likely to be driven on shore.

Charts 575, 828, 70.

Chart 575, plan of Madras roadstead.

Climate.—Winds.—The climate of Madras has been described with some accuracy as three months hot and nine months hotter. In April and May there are occasional squalls from north-west, usually in the
5 early part of the night.

City.—Port facilities.—The city of Madras had in 1951 a population of 1,429,985. Georgetown, the commercial centre of the city, stands immediately behind the harbour. There are several hospitals both government and private to which seamen are admitted.

10 Large stocks of coal are maintained. Coal can be embarked alongside North quay or East quay or at the harbour moorings; the rate of supply is from 15 to 20 tons per hatch per hour.

Large stocks of fuel oil and diesel oil are maintained; it can be supplied at South quay, North quay and at the Northern breakwater
15 at a rate of about 100 tons per hour.

Fresh provisions are available. Fresh water is laid on to South, West and North quays, and can be supplied by water boats to vessels at East quay and the harbour moorings.

Repairs to hull, boilers and machinery can be undertaken. There is
20 a patent slipway in the boat basin capable of taking vessels up to 900 tons. For details, see Appendix I, page 487.

At South quay there is a mobile 33-ton steam crane and two electric cranes of 10-tons and 5-tons capacity, respectively. West quay is equipped with 14 travelling cranes of from 3-5 tons lifting capacity
25 and there is a static 60-ton electric crane at West quay Central berth. There is a 30-ton floating sheer-legs.

About 30 lighters of from 15-40 tons capacity are available.

There are 3 tugs to assist vessels in berthing and two tugs for towing lighters.

30 There is regular sea communication with all parts of the world, and air communication with Bombay, Karachi, Colombo and Trichinopoly.

There is a radio station at Madras, see page 38.

Time signal.—A visual time signal is made at Fort Saint George (*Lat. 13° 05' N., Long. 80° 17' E.*), see Admiralty List of lights, Vol. 6.

35 **Trade and shipping.**—The principal exports are :—Ground nut oil, hides and skins, ores and piece-goods; the chief imports are coal and coke, mineral oil, food grains and chemical manures.

In 1950-51, 1,014 vessels of a total tonnage of 3,763,344 entered the port.

40 **Climatic table.**—See page 72.

Chart 575.

COROMANDEL COAST (*continued*).—**Caution.**—When navigating the Coromandel coast northward of Madras, great care is necessary as the currents are very variable both in rate and direction and
45 sometimes set towards the land.

Madras to Ennur. — Coast. — Anchorage. — From Madras harbour the coast trends north-north-eastward for about 13½ miles to the village of Ennur, situated on the northern side of an extensive backwater. Plantations of casuarina trees commence about 3 miles northward of Madras harbour and continue for several miles. A prominent
50 white temple with a conspicuous framework tower about 150 feet (45m7) in height, close south-westward of it, is situated about 5½ miles north-north-eastward of Madras lighthouse. There are several fishing

Chart 575.

villages on this stretch of coast, and on the strip of land between Ennur backwater and the sea which forms its northern part, are a number of bungalows.

Anchorage, in depths of from $6\frac{1}{2}$ to 7 fathoms (11^m9 to 12^m8), may be obtained about one mile off the entrance to Ennur backwater, with a sandspit on the southern side of the entrance bearing 309° . Vessels bound for Ennur enter and clear at Madras harbour.

Ennur to Pulicat. — Coast. — Light. — Aspect. — Between the entrance to Ennur backwater and the town of Pulicat about 11 miles northward, the coast is low, sandy and backed by an extensive plain which is densely wooded near the beach. Pulicat stands on an island at the southern end of Pulicat lake. The town, which is visible from seaward, had in 1931, a population of 4,164.

A light is exhibited, at an elevation of 68 feet (20^m7), from a masonry tower, 57 feet (17^m4) in height, painted in black and white horizontal bands, situated close within the coast about three-quarters of a mile eastward of the town of Pulicat, and about $1\frac{1}{2}$ miles southward of the main entrance to Pulicat lake. A tall and prominent monument stands close northward of the lighthouse.



Pulicat lighthouse.

Nagari hills are situated from about 30 to 45 miles inland abreast Pulicat and the coast northward. Nagari Nose (*Lat. $13^\circ 23' N.$, Long. $79^\circ 36' E.$*), a sharp peak, 2,812 feet (857^m1) high, the upper part of which is crooked, is situated about 43 miles westward of Pulicat lighthouse and is only visible from seaward in clear weather.

Kettle Bottom is a remarkable flat-topped mountain, 2,839 feet high, lying about 33 miles westward of Pulicat lighthouse. False Kettle Bottom, another flat-topped mountain, situated about 4 miles north-eastward of Kettle Bottom, might be mistaken for the latter when viewed from northward. Kambakkam Drug (Kambakam Durgam), 2,546 feet (776^m0) high, rises about 6 miles farther north-eastward.

Dangers.—Ennur shoal, with depths of less than 3 fathoms (5^m5) over it, and with a least depth of 3 feet (0^m9), extends about 2 miles east-north-eastward from a position on the coast about $2\frac{1}{4}$ miles northward of the mouth of Ennur backwater.

Pulicat shoals consist of a chain of hard sandy patches with depths of from $2\frac{1}{4}$ to $3\frac{3}{4}$ fathoms (4^m1 to 6^m9) over them, situated from 6 to 9 miles north-north-eastward of the mouth of Ennur backwater and from 2 to 3 miles offshore. In 1912, these shoals were reported to be extending eastward and they should not be approached within a depth of 15 fathoms (27^m4). Patches with less than 5 fathoms (9^m1) over them, extend about 2 miles northward of Pulicat shoals.

There are depths of from 4 to 5 fathoms (7^m3 to 9^m1) between the northern end of Ennur shoal and the southernmost patch of Pulicat shoals, but this passage is not recommended.

Pulicat lighthouse in line with Kettle Bottom, bearing 271° , leads northward of Pulicat shoals and the patches with depths of less than 5 fathoms (9^m1), northward of them.

Anchorage.—Anchorage may be obtained, in depths of from $6\frac{1}{2}$ to

Chart 575.

7 fathoms (11^m9 to 12^m8), with Pulicat lighthouse bearing less than 271°, about 2½ miles offshore.

Current.—In the vicinity of Pulicat shoals, the current is weak and sets parallel with the coast.

Pulicat to Kondūr. — Coast. — Beacon. — Between the main entrance to Pulicat lake and Point Pudi, about 20½ miles northward, the coast is low and forms a slight bight in which there are depths of from 5 to 6 fathoms (9^m1 to 11^m0) about half a mile offshore.

10 Pulicat lake is a salt water lagoon in which are several islands ; it lies close within the coast for a distance of about 37 miles north-north-westward of Pulicat lighthouse, being separated from the sea by Sriharikota island, a narrow sandy island about 4½ miles wide at its broadest part.

15 For about 11 miles northward of the main entrance to Pulicat lake the coast is lined with casuarina plantations after which the trees are few until about one mile southward of Point Pudi where, on a sandhill, is a clump of coconut palms, the tops of which are about 80 feet (24^m4) high. Pulinjerikuppam village stands on this stretch of coast about

20 11 miles north-north-westward of the main entrance to Pulicat lake ; a wooden beacon, 35 feet (10^m7) high, stands about half a mile northward of the village but is not conspicuous from seaward.

Point Pudi is low and sandy with hillocks 15 feet (4^m6) high on it and clumps of palms in the vicinity. A sandy spit with depths of from 25 one to 2½ fathoms (1^m8 to 5^m0), extends about 2½ miles south-eastward from the point. In rough weather, the sea breaks over this spit at a distance of about one mile offshore.

From Point Pudi (*Lat. 13° 46' N., Long. 80° 15' E.*), the coast trends north-north-westward for about 15 miles to Kondūr, a small village

30 situated near the northern end of an extensive backwater ; the larger village of Dugarazupatnam, formerly called Armagon, is situated on this backwater, about 2 miles southward of Kondūr. Armagon disused lighthouse, a cylindrical tower, 101 feet (30^m8) in height, stands on the coast about 7 miles north-westward of Point Pudi and close southward of Monapālem village.

Armagon shoal.—Armagon shoal is an extensive shoal ridge on which the depths are less than 5 fathoms (9^m1), with a least depth of 1½ fathoms (3^m2). Its southern end is situated about 1½ miles north-eastward of Point Pudi, and the shoal extends about 14 miles northward. The sea sometimes breaks over its shoalest part, situated about

45 1½ miles from its southern end. There is a channel about half a mile wide, with depths of from 4 to 6 fathoms (7^m3 to 11^m0) in it, between Point Pudi and the southern end of the shoal, but it should only be used by vessels with local knowledge.

Blackwood harbour. — Anchorage. — Directions. — Blackwood harbour is the area between Armagon shoal and the coast.

Armagon old lighthouse is the best landmark near Armagon shoal ; Gūdāli hill, about 13 miles north-westward of the old lighthouse, is prominent and flat-topped, with a pagoda near its centre, but it is seldom visible from the outer part of Armagon shoal.



*Armagon old
lighthouse.*

Chart 575.

Anchorage may be obtained in a depth of 5 fathoms (9^m1), coarse sand and good holding ground, with Armagon old lighthouse bearing between 282° and 290°; during the South-west monsoon a convenient berth is with the old lighthouse bearing 259°, distant 2½ miles. 5

When approaching this part of the coast it must be remembered that the land is sometimes obscured by haze, and that the current, though generally setting with the prevailing wind, sometimes sets in the opposite direction. Every precaution, therefore, must be taken and the shoal should not be approached within depths of 20 fathoms 10 (36^m6), which lie from about 2½ to 5½ miles eastward of the shoal.

If intending to enter Blackwood harbour, a vessel should keep in depths of not less than 12 fathoms (21^m9), until Armagon old lighthouse bears 207°, or Gūdāli hill bears 259°; she should then steer for Gūdāli hill on that bearing, passing northward of Armagon shoal in 15 depths of about 6 fathoms (11^m0).

Kondūr to the mouth of Penner river.—Coast.—Danger.—Swarnamukhi river enters the sea through an extensive backwater, the southern mouth of which lies about 3½ miles northward of Kondūr and the northern mouth, about 3 miles farther northward. The town 20 of Kottapatam, near which are two distinctive casuarina clumps, is situated about one mile westward of the northern mouth of the backwater. Swarnamukhi river is too shallow even for boats.

The entrance to Upputeru river is situated about 7½ miles northward of the northern mouth of Kottapatam backwater and this entrance 25 also leads to an extensive backwater which can be used safely by light-draught native craft. Kistnapatam, a village about 2½ miles north-north-westward of the entrance and near the northern end of the backwater, is the chief port of the town of Nellore, about 13 miles farther north-westward. 30

Coasting craft occasionally anchor about 2 miles off the entrance to Upputeru river, in depths of from 5½ to 6 fathoms (10^m1 to 11^m0), but this anchorage is only safe during fine weather.

Casuarina plantations line the coast for about 3 miles northward of the entrance to Upputeru river, whence they terminate abruptly and 35 for a further 5 miles northward the coast consists of sandhills from 30 to 60 feet (9^m1 to 18^m3) high; thence to the mouth of Penner river, about 13 miles farther northward, the coast is low and sandy with a few clumps of casuarina and other trees but no prominent landmarks. 40

Shallinger shoal (*Lat.* 14° 23' N., *Long.* 80° 12' E.), a spit with depths of from 1½ to 2½ fathoms (2^m7 to 5^m0) over it, extends about 2½ miles north-eastward from the coast at about 7½ miles northward of the entrance to Upputeru river. A detached 3-fathom (5^m5) patch lies about 1½ miles southward of the extremity of Shallinger shoal, but 45 eastward of the shoal the depths are regular and the coast may be approached safely to a depth of 8 fathoms (14^m6).

Penner river.—Anchorage.—The mouth of Penner river is not easily distinguished as the river enters the sea behind a sandy point which is only a few feet high. 50

Nellore, the chief town of the district, is situated on rising ground on the southern bank of Penner river, about 15 miles above its mouth; in 1931, the town of Nellore had a population of 45,895. Narsimhakonda pagoda, painted white and situated on a hill 504 feet (153^m6)

Chart 575.

high, about 6 miles westward of Nellore, is sometimes visible from seaward between the bearings of 293° and 248° , but it is not very conspicuous. Penner river is so shallow between the mouth and

5 Nellore, that only native craft can enter; it is liable to sudden freshets. In fine weather and with offshore winds, anchorage may be obtained in depths of from 5 to 7 fathoms (9^m1 to 12^m8), sand and mud, about $1\frac{1}{2}$ miles off the mouth of the river.

Winds.—See Percentage frequency of wind direction at coast
10 stations, page 89.

Penner river entrance to Ramayapatnam.—**Coast.**—**Anchor-
age.**—**Danger.**—Northward of the mouth of Penner river the coast continues low and sandy but the clumps of casuarinas are more continuous, and the trees are higher, than southward of that river.

15 The Buckingham canal, which connects Madras with the delta of the Kistna river, a distance of about 200 miles, passes close within the coast between the mouth of the Penner river and Ramayapatnam at distances from a few hundred yards to 2 miles. It is largely used by native craft and their masts or sails may generally be seen from
20 seaward when northward of Penner river.

At Iskapalli village, situated close within the coast about 10 miles northward of the mouth of Penner river, there is a flagstaff on the beach which shows over the trees. About 10 miles west-south-westward of Iskapalli is Nishanbotu, the northern end of a ridge running roughly
25 parallel with the coast southward of Iskapalli.

Anchorage may be obtained, in depths of from 7 to 8 fathoms (12^m8 to 14^m6), sand and mud, about one mile offshore, north-eastward of a bungalow which lies about one mile eastward of Iskapalli. The holding ground is good but there is a heavy surf on the beach.
30 *Charts 575, 1894.*

Between Iskapalli and Ramayapatnam, about 19 miles northward, the coast continues low and sandy and for the first 7 miles, as far as the village of Vattūrupallem, is covered with low scrub with a single large clump of tall casuarinas about $1\frac{1}{2}$ miles southward of the
35 latter village. Northward of Vattūrupallem there are at first a few detached clumps after which the trees are very even as far as Ramayapatnam.

A shoal with a least depth of $2\frac{3}{4}$ fathoms (5^m0) over it, is situated about $2\frac{1}{2}$ miles offshore abreast the village of Tummalapenta, about
40 4 miles northward of Vattūrupallem. The depths are very irregular within about one mile, and for about 7 miles northward of the shoal and the coast in this vicinity should not be approached within a depth of 10 fathoms (18^m3) till northward of Ramayapatnam (*Lat. $15^{\circ} 03' N.$, Long. $80^{\circ} 03' E.$*).

45 At Ramayapatnam village there are some tall casuarina clumps and a church, the red spire of which is visible from seaward over the trees. Tettu temple, 135 feet (41^m1) high and painted white but not very conspicuous, is situated about 2 miles inland of the village.
Chart 1894.

50 **Ramayapatnam to Kottapatam.**—**Coast.**—Between Ramayapatnam and the town of Kottapatam about 25 miles north-north-eastward, the coast continues low and sandy. There are several detached clumps of casuarinas on the stretch between Ramayapatnam and the entrance to Uppūteru river, about $10\frac{1}{2}$ miles northward, and

Chart 1894.

about 4 miles west-south-westward of the mouth of the latter river is Singarāyakonda temple ; it stands on a hill 168 feet (51^m2) high, is painted red, and is one of the few prominent landmarks between Ramayapatnam and Kottapatam. The rising ground near the temple is visible in places between the casuarinas which fringe the coast. 5

Paleru river enters the sea about 6 miles northward of the mouth of Uppūteru river ; a beacon stands on the southern entrance point of the former river. Boat entrances are indicated on the chart at the entrances to both rivers. 10

Kandalur and Konijedu, two hills connected by a ridge, lie about 11 miles westward of Kottapatam and are useful landmarks ; Konijedu has an elevation of 485 feet (147^m8). Chimakurti, 2,093 feet (637^m9) high, situated about 22 miles west-north-westward of Kottapatam, is also a good landmark. 15

Kottapatam. — Obelisk. — Off-lying dangers. — The town of Kottapatam is situated about one mile inland, and a prominent white obelisk, about 50 feet (15^m2) in height, stands about one mile north-westward of the town.

A shoal about 2½ miles in extent, over which there are depths of less than 3 fathoms (5^m5), lies about 1½ miles offshore north-eastward of Kottapatam ; a least depth of 1½ fathoms (2^m7) exists on this shoal about 5 miles north-eastward of the obelisk referred to above. Between the southern end of this shoal and the coast, there is a detached 2¾-fathom (5^m0) patch, and within one mile south-eastward of the shoal there are two detached 3-fathom (5^m5) patches ; irregular depths, marked by overfalls, exist between the shoal and Mutapolli bank, about 5 miles eastward. 20 25

Mutapolli bank, with depths of 5 fathoms (9^m1) and less over it, has a least depth of 3½ fathoms (6^m4) situated about 8 miles offshore, eastward of Kottapatam. 30

About 2 miles south-westward of Mutapolli bank there is a shoal about 4 miles in extent with a least depth of 5½ fathoms (10^m1) over it. About 2 miles north-eastward of the bank there is a similar shoal with a least depth of 5 fathoms (9^m1) over it ; two detached 6-fathom (11^m0) patches lie, respectively, about one mile, and 6 miles, north-eastward of this shoal. 35

Mutapolli bank is generally marked by overfalls, but, from the outer part of the bank the low coast is scarcely visible, and even in clear weather, Kandalur and Konijedu are seldom visible. The bank should not be approached within a depth of 14 fathoms (25^m6) by day, or of 30 fathoms (54^m9), by night, and it must be borne in mind that within the latter depth the soundings decrease rapidly. 40

Anchorage.—Anchorage may be obtained during fine weather about 2½ miles offshore, in a depth of 5 fathoms (9^m1), with Kottapatam bearing about 295°. The anchorage should not be approached within a depth of 10 fathoms (18^m3) until the vessel's position has been ascertained. 45

Nizāmpatam bay. — Beacons. — Anchorage. — Nizāmpatam bay is entered between Kottapatam and False Divi point (*Lat.* 15° 43' N., *Long.* 80° 50' E.), about 41 miles east-north-eastward. Except for the shoals near Mutapolli bank, mentioned above, the bay is free from dangers and its shores may be approached with safety to a depth of 5 fathoms (9^m1). 50

Chart 1894.

Gundlakamma river enters the sea about 6 miles north-north-eastward of Kottapatam ; the confluence of this river with Mudiganderu, another river which enters the sea about 2 miles southward, forms an extensive backwater close within the coast. Only boats can enter Gundlakamma river and those only in fine weather ; during the months of September, October and November the river comes down in freshets and at high water is navigable for about 2 miles within its mouth.

- 10 A beacon stands about half a mile within the mouth of Mudiganderu. From the mouth of Gundlakamma river, the shore of Nizāmpatam bay curves north-eastward for about 35 miles to the entrance of a creek leading to the town of Nizāmpatam. For the first 4 miles of this stretch the coast is low and sandy with few trees, thence for about 15 19 miles north-eastward, the sandhills near the coast are lined with casuarinas from 30 to 40 feet (9^m1 to 12^m2) high, which, in places, extend more than one mile inland. The casuarinas terminate about 13 miles west-south-westward of Nizāmpatam and the intervening stretch of coast is backed by sandhills from 6 to 8 feet (1^m8 to 2^m4) 20 high, rising to elevations of from 20 to 30 feet (6^m1 to 9^m1) towards Nizāmpatam.

About 8½ miles north-north-eastward of the mouth of Gundlakamma river, is a boat passage leading to a backwater and to the Buckingham canal. The entrance has a south-westerly direction across a bar 25 which has a least depth of 6 feet (1^m8) on it but is only passable for boats, even in fine weather.

Coasting vessels may obtain anchorage, in depths of from 5 to 6 fathoms (9^m1 to 11^m0), sand and mud, about 1½ miles offshore abreast the village of Vadarevu, situated about 19 miles north-north-eastward 30 of the mouth of Gundlakamma river.

Dindi house, a large building, stands on the beach on the northern entrance point of the creek leading to Nizāmpatam ; close eastward of the house is a big tree, the top of which is 67 feet (20^m4) high.

Between Dindi house and False Divi point, about 12½ miles south- 35 eastward, the eastern side of Nizāmpatam bay forms a bight, at the head of which, about 5 miles eastward of Dindi house, is the entrance to a creek, navigable by boats and marked by a beacon on its north-western entrance point.

False Divi point is low and covered with small mangroves. About 40 2½ miles northward of the point, a spit projects about 4 miles farther northward, leaving an entrance at the northern end and forming a considerable backwater which is connected by creeks with Kistna river, *see* below.

A bank which dries in patches extends about one mile southward, 45 and about 3 miles westward of False Divi point (*Lat.* 15° 43' N., *Long.* 80° 50' E.).

Chart 828.

Kistna river.—Kistna river rises about 40 miles from the Western Ghāts at Mahabaleshwar, in the Bombay state and flows eastward 50 across the peninsula of India, into the Bay of Bengal by several branches, the mouth of one being near False Divi point.

The enormous amount of silt carried by the river has formed a wide alluvial delta, which extends seaward ; at Bezwada, at the head of this delta about 50 miles north-north-westward of False Divi point,

Chart 828.

a large masonry dam crosses the river and turns it into a network of irrigation channels spreading throughout the delta.

Between Bezwada and the mouth, sea-going native craft use the river for about six months of the year ; the main irrigation channels 5 are also navigable.

Chart 1894.

False Divi point to Divi point.—Coast.—Between False Divi point and Divi point, about 24 miles north-eastward, the coast is low and monotonous with a sandy foreshore and occasional low sandhills 10 backed by a fringe of jungle, from 30 to 40 feet (9^m1 to 12^m2) high. Divi point is low and sandy with a little scrub on it ; the eastern mouth of the main branch of Kistna river lies about one mile westward of Divi point.

Kistna old lighthouse, a white masonry tower, 144 feet (43^m9) in 15 height, is situated about 9½ miles east-north-eastward of False Divi point, on the north-eastern bank of one of the branches of Kistna river ; another old lighthouse, a white masonry tower, 50 feet (15^m2) high, is situated about 2¼ miles north-westward of Divi point, on the eastern bank of the main branch of the river, and is maintained as a 20 landmark.

Current.—In March, the current off Divi point has been found setting eastward at a rate of 1½ knots.

Directions.—As the coast between False Divi point and Divi point is very low and frequently obscured by haze, vessels bound 25 eastward from Nizāmpatam should be guided principally by soundings. By day, they should not approach within depths of 8 fathoms (14^m6) when between False Divi point and Divi point, and within depths of 6 fathoms (11^m0) when off other parts of the coast in the vicinity. At night, great caution is necessary, and it must be borne in mind that the 30 bank of soundings extends only a few miles seaward.

Chart 1894 and plan of Masulipatam roads.

Masulipatam. — Landmarks. — Beacon. — The port of Masulipatam, the chief port of Kistna district, is situated about 2 miles within the mouth of a creek about 11 miles northward of Divi point. 35 There is a least depth of one foot (0^m3) over a bar at the mouth of the creek during the dry season. Vessels anchor off the mouth of the creek in an open roadstead, and cargo is handled by native boats which can cross the bar at high water. At the port, cargo is loaded and unloaded at wharves which are situated abreast a lock (*Lat.* 16° 09' N., 40 *Long.* 81° 09' E.) separating the head of the tidal creek and Masulipatam canal.

During the months of October, November and December, boats are very occasionally unable to cross the bar and communicate with shipping owing to the weather. 45

A prominent chimney about 94 feet (28^m7) high, stands about 3¼ miles north-north-westward of the entrance to the creek and is reported to be the first object sighted when approaching the port from eastward.

Two long and wedge-shaped clumps of casuarina trees, the northern 50 ends being the higher, are situated about one mile northward of the entrance to the creek. About 3¼ miles farther north-north-eastward and about 3 miles north-eastward of the prominent chimney, is a small pointed clump, and about one mile north-eastward of this clump and

Chart 1894 and plan of Masulipatam roads.

close to the coast, is North clump, which is large, very compact and 60 feet (18^m3) high ; it often appears like an island, the trees northward and southward of it being of a lighter colour.

- 5 A beacon, about 20 feet (6^m1) high, stands on the coast about 10 miles north-eastward of the prominent chimney, but is not conspicuous.

Chart 1894, plan of Masulipatam roads.

- Light.—Storm signals.—Buoy.**—A light is exhibited, at an elevation of 43 feet (13^m1) from a white masonry tower, 43 feet (13^m1) in height, situated about a quarter of a mile westward of the southern entrance point of the creek.

The brief system of storm signals is in use at Masulipatam, see pages 30 and 33.

- 15 A conical buoy, painted black with the letter "A" in white, is moored about 4 miles eastward of Masulipatam lighthouse ; it marks the position for boats to wait outside the bar in order to communicate with vessels approaching the port.

- Winds.**—See Percentage frequency of wind direction at coast stations, page 89.

Anchorage. — Regulations. — Directions. — The roadstead is capacious and the holding ground is good, but during the North-east monsoon with a ground swell, communication with the shore is tedious and uncertain.

- 25 From January to September inclusive, vessels should anchor according to draught, with the lighthouse bearing 270°, and in October, November and December, with the lighthouse bearing 288°.

Ballast may not be thrown overboard in depths of less than 10 fathoms (18^m3).

- 30 *Chart 1984.*

Vessels bound for Masulipatam from southward, should make False Divi point and then stand north-eastward, keeping in depths of not less than 8 fathoms (14^m6). After passing False Divi point, vessels should sound constantly.

- 35 During the North-east monsoon, vessels should invariably make Narasapur point (*Lat.* 16° 18' N., *Long.* 81° 43' E.) (page 199), and then shape course for the anchorage.

Chart 1894, plan of Masulipatam roads.

- Town.—Port facilities.**—The town consists of three parts, the fort, 40 the native quarter and the European quarter. The fort itself is almost non-existent but the name includes the port offices, wharves, storehouses and adjoining buildings ; around the fort is a large expanse of waste land across which a causeway leads to the native town about 2 miles north-westward. Northward of the native quarter and along 45 a sandy ridge, are the houses of the European residents. In 1931, the population was 56,928. There is a Government hospital in the town which admits seamen.

- Limited supplies of provisions are available and water can be supplied in barrels by native craft, but owing to difficulties in transportation, watering is not recommended at this port.

50 There are six wharves with a total length of 2,215 feet (675^m1) at the port ; three of these wharves are on the tidal side of the lock and the remainder in Masulipatam canal. There is a 3-ton crane on one of the tidal wharves.

Chart 1894, plan of Masulipatam roads.

There are 30 lighters of about 25-tons capacity and there are several small native cargo boats.

The principal exports are ground nuts, linseed, oilcake and rice ; imports have practically ceased since 1946-47 and in 1949 consisted 5 only of small quantities of timber from coastal villages.

In 1948-49, exports amounted to 36,758 tons and imports to 245 tons.

There is regular sea communication with other Indian ports through Madras.

Chart 1894.

Masulipatam to Vanteyam Godāvari river entrance.—Coast.—Obelisk.—Between Masulipatam lighthouse and Narasapur point, about 32 miles east-north-eastward, the coast curves and forms a bight the shores of which are low, sandy and, for the first 8 or 9 miles, densely 15 wooded ; for the next 10 miles or so the trees are more scattered after which they again become thicker and continue so to Narasapur point, which is itself low and wooded. For landmarks northward of Masulipatam, see page 197.

The above stretch of coast may, with care, be approached to depths 20 of 7 fathoms (12^m8), except off Narasapur point, where vessels should not approach within depths of 20 fathoms (36^m6) at night.

The current in the bight westward of Narasapur is weak and variable. *Charts 1894, 1711.*

An obelisk, 80 feet (24^m4) in height, stands about one mile northward 25 of the extremity of Narasapur point.

Vasishta Godāvari river, the southernmost mouth of Godāvari river, enters the sea on the western side of Narasapur point. There are depths of about 7 feet (2^m1) over a bar at its entrance, which extends about 2 miles southward from the point, with depths of from 2 to 30 4 fathoms (3^m7 to 7^m3) inside. The channel across the bar lies between two sandbanks on which the sea breaks.

Between Narasapur point and the mouth of Vanteyam Godāvari river, about 15 miles east-north-eastward, the coast continues to be low and densely wooded. The entrance to Vanteyam Godāvari is 35 named Warreo and during freshets, a spit forms off it. Warreo clumps, two large and prominent clumps of casuarinas, stand on the eastern bank of the river close within the entrance. This stretch of coast may be approached safely to depths of 10 fathoms (18^m3).

Current.—During January and February at about 9 miles off the 40 coast between Narasapur point and the mouth of Vanteyam Godāvari river (*Lat. 16° 24' N., Long. 81° 57' E.*), the current sets westward with a maximum rate of 2 knots.

Chart 1711 and plan of Sacramento shoal.

Vanteyam Godāvari entrance to Vrudha Gautami entrance.— 45 Coast.—Light.—From the mouth of Vanteyam Godāvari river, the coast trends east-north-eastward for about 23 miles to the mouth of Vrudha Gautami river, which is the southern entrance of Gautami Godāvari river.

Sacramento light is exhibited, at an elevation of 140 feet (42^m1), 50 from a masonry tower, 148 feet (45^m1) in height, situated about 2 miles west-north-westward of Vrudha Gautami entrance and about half a mile inland.

Shoal.—Buoy.—Sacramento shoal, of hard sand, is the name given

Charts 828, 829, 70.

Chart 1711 and plan of Sacramento shoal.

to the shoal at the entrance to Vrudha Gautami river. The shoal is liable to frequent changes in position and depth and, in 1948, extended about 4 miles south-eastward and $3\frac{1}{2}$ miles eastward from the light-house; there were then depths of from $1\frac{1}{2}$ to 3 fathoms (2^m7 to 5^m5) over the shoal, on which the sea usually breaks.

In May, 1948, a small black drum buoy was moored about $5\frac{1}{4}$ miles south-eastward of the lighthouse and depths of less than 6 and 3 fathoms (11^m0 and 5^m5) were then reported about $1\frac{1}{2}$ miles westward and north-westward, respectively, of this position.

Anchorage.—Landing.—Small vessels with local knowledge can anchor, in a depth of 4 fathoms (7^m3), mud, about one mile offshore eastward of Māsānutippa, situated about $4\frac{1}{2}$ miles north-north-eastward of Sacramento lighthouse; or, in a similar depth, sand and mud, with Sacramento lighthouse bearing 000° , distant about 2 miles; these anchorages are sheltered to some extent from south-west and north-east winds, respectively.

Landing, sheltered from south-west, can be effected on the coast near the mouth of a small creek, which dries, about 3 miles north-eastward of the lighthouse.

Vrudha Gautami river.—Depths.—A narrow sandspit, from one foot to 4 feet (0^m3 to 1^m2) high, extends in a north-easterly and south-westerly direction in the mouth of the river, its southern extremity lying about $2\frac{1}{2}$ miles east-south-eastward of Sacramento lighthouse; in 1948, the entrance channel lay between the south-western end of this spit and the shoal water extending south-eastward from Sacramento lighthouse. At that date, the bar was situated between $1\frac{1}{4}$ and 2 miles southward of the south-western end of the sandspit, and there was a least depth of 2 fathoms (3^m7) in the channel across it.

Small craft with local knowledge can enter the river in fine weather. Inside the bar the depths increase and there are depths of from 28 to 34 feet (8^m5 to 10^m4) in the river for about $2\frac{3}{4}$ miles above the entrance.

The river is joined by two tributaries close within its mouth and during the wet season the outgoing stream may attain a rate of 4 knots.

Current.—During the months of January to April inclusive, a current sets north-eastward at a short distance from the coast in the vicinity of Sacramento shoal; at a distance of 5 miles offshore, its greatest rate is 4 knots.

Vrudha Gautami entrance to Godāvāri point.—Coast.

Beacon.—Between the mouth of Vrudha Gautami river and Godāvāri point (*Lat.* $16^\circ 58' N.$, *Long.* $82^\circ 20' E.$), about 24 miles northward, the coast is very low and, in this vicinity, distances judged by eye are likely to be erroneous owing to the sand haze.

Māsānutippa temple, at the southern end of the village of that name, stands on the coast about $4\frac{1}{2}$ miles north-north-eastward of Sacramento lighthouse; although not conspicuous, this temple is one of the few objects that can be identified between the mouth of Vrudha Gautami river and Hope island old lighthouse, about 15 miles northward.

Chart 1711.

The coast northward of Māsānutippa village is fringed by a series of low and narrow sandbanks which in places are covered with low scrub, and on which the sea breaks heavily during the South-west monsoon. Hope island, one of a chain of similar islands, situated about 10 miles

Chart 1711.

northward of Māsānutippa temple close within the coast and forming part of the delta of Godāvari river, is low, swampy and covered with jungle ; it is only 3 feet (0^m9) high and is sometimes submerged during exceptionally high tides.

5

Chart 1711, plan of Cocanāda bay.

A disused lighthouse painted in black and white horizontal bands, is situated on Hope island, about 9½ miles southward of Godāvari point.

Godāvari point, the northern extremity of the narrow sandbanks 10 mentioned above, is the south-eastern entrance point of Cocanāda bay. The entrance to Cocanāda river lies about 3½ miles west-south-westward of Godāvari point.

A steel tripod beacon, surmounted by a framework ball, stands close within the northern extremity of Godāvari point (*Lat.* 16° 58' N., 15 *Long.* 82° 20' E.).

Current.—*See* page 207.

Charts 1711, 828, 829, 70.

CHAPTER V

COCANĀDA TO BALISAHI POINT

Chart 1711, plan of Cocanāda bay.

- COCANĀDA BAY AND PORT.**—Cocanāda bay.—**Land-marks.**—Cocanāda bay is entered between Godavāri point (*Lat. 16° 58' N., Long. 82° 20' E.*) and the coast about $4\frac{1}{4}$ miles north-north-westward, and extends about 8 miles south-south-westward from the entrance; it is a shallow bay, the head of which is filled with extensive drying mud flats. It is the safest natural harbour on the east coast of the Indian sub-continent, but for many years the bay has been silting up due to the deposit brought down by Godāvari river.
- 10 The town and port of Cocanāda is situated on the western side of the bay about 2 miles within the entrance to Cocanāda river, the mouth of which lies about $4\frac{1}{2}$ miles west-south-westward of Godāvari point.

- The shores of the bay are low and liable to periodic inundations during cyclonic storms. Prominent landmarks in the vicinity are :—
- 15 The disused lighthouse on Hope island, mentioned on page 201; several oil tanks situated on the northern side of the mouth of Cocanāda river, about 5 miles west-south-westward of Godāvari point; and Vākalapūdi lighthouse, situated close within the beach about 4 miles north-westward of Godāvari point.
- 20 The port of Cocanāda comprises a partly open anchorage situated about 3 or 4 miles north-north-eastward of the entrance to Cocanāda river and suitable for ocean-going vessels; cargo is transported between the anchorage and wharves on the river bank abreast the town, by native lighters.

- 25 The limits of the port are defined on shore by boundary pillars and extend seaward to depths of 13 fathoms (23^m8). The northern boundary pillar, 14 feet (4^m3) in height and painted white, stands about 7 cables north-eastward of Vākalapūdi lighthouse.

- Shoals in approach.**—Two shoals with depths of $6\frac{1}{2}$ and 7 fathoms (11^m4 and 12^m7) over them, lie about $1\frac{1}{2}$ miles north-eastward, and $2\frac{3}{4}$ miles north-north-eastward, respectively, of the beacon on Godāvari point.

- Lights.**—**Signal station.**—**Storm and weather signals.**—A light is exhibited, at an elevation of 80 feet (24^m4), from a grey masonry tower, 76 feet (23^m2) in height, at Vākalapūdi, about $4\frac{1}{2}$ miles northward of the entrance to Cocanāda river.

A light is exhibited, at an elevation of 18 feet (5^m5), from a white masonry tower, situated on Godāvari point, about $4\frac{1}{4}$ miles south-eastward of Vākalapūdi lighthouse.

Charts 1711, 828, 829, 70.

Chart 1711, plan of Cocanāda bay.

A light is exhibited, at an elevation of 28 feet (8^m5), from a grey steel framework structure on a concrete base, 6 feet (1^m8) in height, situated at the outer end of a groyne which extends about half a mile north-eastward from the northern side of the entrance to Cocanāda river. 5

There is a signal station at Vākalapūdi lighthouse ; it is in telephonic communication with the Port office. Vessels can communicate with the station by morse code between 1800 and 2400 and between 0400 and 0600.

The extended system of storm signals, *see* pages 30 to 34, is in use 10 at Cocanāda.

Buoy.—A black can buoy, situated about 1½ miles south-south-eastward of the mouth of Cocanāda river, marks a dumping ground.

Anchorage.—**Shoal.**—In 1942, there was safe anchorage with good holding ground, in a depth of about 3¼ fathoms (5^m9), soft mud, 15 with Vākalapūdi lighthouse (*Lat.* 17° 01' N., *Long.* 82° 17' E.) bearing 321°, distant 2·8 miles. Vessels anchor here at all seasons, and although about 3¼ miles from the mouth of Cocanāda river, communication between vessels and the shore is seldom impeded, the sea in the bay being generally smooth. At the same date, another anchorage in use 20 was in a depth of about 3 fathoms (5^m5), with Vākalapūdi lighthouse bearing 318°, distant about 14 cables.

During the North-east monsoon, a good anchorage is in a depth of about 4 fathoms (7^m3) with Vākalapūdi lighthouse bearing 316°, distant 3·7 miles. 25

Anchorage is shown on the chart in a depth of about 5½ fathoms (10^m5), with Vākalapūdi lighthouse bearing 276°, distant about 2·7 miles, but sunken wrecks lie about 3 cables southward, and 5 cables south-eastward of this position and in 1942, a shoal, with a depth of 4½ fathoms (8^m7) over it, was reported to lie about 6 cables north-westward of this anchorage and about 2¼ miles eastward of Vākalapūdi lighthouse. 30

During June 1945 good anchorage was obtained off Godāvāri point, in a depth of 6 fathoms (11^m0), mud, with Vākalapūdi lighthouse bearing 307°, distant about 3¼ miles. During the same period, anchorage 35 in the bay eastward of Vākalapūdi lighthouse was found to be subject to considerable ground swell from south-eastward, even when there was no wind.

Tidal streams.—The tidal stream sets north-eastward during the falling tide and south-westward during the rising tide. The tidal streams at springs are strong and must be taken into account when closing the land. From October to February, the tidal streams will be combined with a south-westerly current. 40

At the first two anchorages mentioned above there is very little tidal stream ; it is usually slack during the rising tide and sets north-eastward during the falling tide. 45

In June 1945, at the anchorage off Godāvāri point, mentioned above, the tidal stream was most marked and followed the contour of the land, reaching a maximum velocity at about 4 cables from the point. It appeared to have a rate of about half a knot on the flood, and from 50 1½ to 2 knots on the ebb.

Chart 1711.

Regulation.—No ballast is permitted to be thrown overboard in depths of less than 12 fathoms (21^m9).

Charts 828, 829, 70.

Chart 1711.

Directions.—Aspect.—Northward of Cocanāda the land appears bold, with high land extending north-eastward ; southward of Cocanāda the coast is low and sandy, interspersed with a few sandy hillocks, 5 palmyra trees or low jungle.

During the North-east monsoon, vessels should make a landfall near Pentakota, 30 miles north-eastward of Cocanāda, and should then run along the coast in depths of not less than 12 fathoms (21^m9). By day, when Vākalapūdi lighthouse bears about 248°, course should be shaped 10 for the anchorage ; at night, Vākalapūdi light should be kept on that bearing until the depths decrease to 10 fathoms (18^m3), when course should be shaped about 233°, keeping Cocanāda river entrance light on that bearing, when sighted, and anchoring in depths of about 7 or 8 fathoms (12^m8 or 14^m6) when Vākalapūdi light bears 293°, distant 15 about 3 miles.

Chart 1711, plan of Cocanāda bay.

Town.—Cocanāda river.—Port facilities.—Cocanāda town (*Lat.* 16° 57' N., *Long.* 82° 14' E.), situated on a sandy plain a little above sea level, about 2 miles westward of the mouth of Cocanāda river, 20 is the headquarters of the District administration ; it lies in close proximity to the rich deltas of the Godāvāri and Kistna rivers, with both of which it is connected by road, rail and canal. Cocanāda river is canalised, and canalised waterways extend into the hinterland ; locks limit the beam of craft using these waterways to 12 feet (3^m7). 25 In 1947, the population of the town was about 75,000 including about 80 Europeans.

Two groynes, about 250 feet (76^m2) apart, project about 6 cables north-eastward from the mouth of Cocanāda river and between them, a canal of sufficient depth to enable cargo lighters to operate at all 30 times with shipping at the anchorage, is maintained by dredging. A dredged channel, about 300 feet (91^m4) wide, leading to the entrance to the canal, is marked by buoys, the outermost buoys of this channel being moored about 8 cables north-eastward of the outer ends of the groynes.

35 A wooden wharf, 107 feet (32^m6) in length and known as the Crane wharf, is situated on the northern side of the canal, about 1½ miles westward of the roots of the groynes ; the wharf has a depth of 7 feet (2^m1) alongside and is equipped with one mobile steam crane of 10 tons lifting capacity and 5 small hand cranes of from half a ton to 5 tons 40 lifting capacity.

The Passenger jetty is also situated on the northern side of the canal, close westward of the Crane wharf ; it is 100 feet (30^m5) in length with a depth of 7 feet (2^m1) alongside and is suitable for berthing lighters and launches.

45 In addition to the Crane wharf and the Passenger jetty, there are about 35 small lighter wharves farther up river, with depths of from 4 to 6 feet (1^m2 to 1^m8) alongside.

Small quantities of fresh provisions are available and fresh water can be supplied in casks by native boats.

50 Minor repairs to powered vessels and all repairs to native sailing vessels can be undertaken. There is a dry dock at Cocanāda, for details of which see Appendix I, page 487. A small slipway is situated in the vicinity of the oil tanks.

There are about 27 cargo lighters at the port with capacities of from

Charts 1711, 828, 829, 70.

Chart 1711, plan of Cocanāda bay.

30 to 60 tons. Four small tugs are available for towing lighters between the wharves and the anchorage.

There is a Government hospital to which seamen are admitted. Beri beri disease is endemic, but is mostly confined to natives. 5

The principal exports are tobacco, palmyra fibre, castor oil, crushed bones and ground nuts; and the chief imports are timber, kerosene oil, wheat and wheat products.

There is regular sea communication with Madras and other Indian ports and with Burma. 10

In 1948-49, exports amounted to 58,807 tons and imports to 2,937 tons.

Climatic table.—See page 73.

Chart 1711.

Godāvari river.—Godāvari river, which rises in the Nasik district, 15 about 70 miles north-eastward of Bombay, is described on page 8.

The northern and principal mouth of Godāvari river is in the south-eastern corner of Cocanāda bay, where the river flows into the sea between the spit extending northward to Godāvari point and Hope island. There are depths of about one foot (0^m3) over the bar of this 20 entrance, and within the river the depths increase.

COROMANDEL COAST (*continued*).—The Coromandel coast extends north-eastward to the boundary between the states of Orissa and Bengal, but that part of the coast between Cocanāda and Ganjām (page 217) is generally known as the Northern Circars, and the part 25 north-eastward of Ganjām as the Orissa coast.

Vākalapūdi lighthouse to Dolphin's nose.—**Coast.**—**Beacons.**—From Vākalapūdi lighthouse (*Lat. 17° 01' N., Long. 82° 17' E.*), the coast trends north-eastward for about 25 miles to the village of Pentakota. For about the first 10 miles of this stretch, the coast is 30 low with numerous villages and coconut trees, after which, as far as Pentakota, it is backed by low sand hills, from 20 to 30 feet (6^m1 to 9^m1) high; in the background is Round hill, 2,143 feet (653^m2) high, situated about 22 miles northward of Vākalapūdi lighthouse, which shows up well in clear weather when seen from near Cocanāda. 35 Uppāda, a village on the coast about 4½ miles north-eastward of Vākalapūdi lighthouse, is a port of call for small native coasting craft.

A masonry beacon stands on the beach about 12 miles north-eastward of Uppāda but it is difficult to identify.

The village of Pentakota stands on the banks of a river at the 40 entrance to which are two sandhills of moderate height with a coconut grove close to them. The river is closed during the South-west monsoon at which time a heavy sea rolls in. Lokarupswāmi temple, painted white and surmounting a hill 310 feet (94^m5) high about 4 miles north-westward of Pentakota, is a good mark, as also is Sudi konda, 45 a cone-shaped hill, 523 feet (159^m4) high, situated about 2½ miles northward of the same point.

Between Pentakota and Dolphin's nose, a headland on the southern side of the entrance to Vizagapatam, about 45 miles east-north-eastward, the coast is backed by a succession of rounded hills which rise 50 from a low sandy plain and which show up well at night. A prominent white obelisk stands on smooth rising ground, about 4 miles north-eastward of Pentakota and about half a mile inland.

Charts 829, 70.

Chart 1711.

A small but very prominent rocky eminence, 72 feet (21^m9) high, surmounted by a beacon, 15 feet (4^m6) in height, stands on the beach at Pāta Polavarem, about 13 miles east-north-eastward of Pentakota.

5 Sanjib peak, a remarkable conical peak, 2,139 feet (652^m0) high, with a somewhat flattened and broken summit, rises about 11 miles north-westward of Pāta Polavarem.

About 3½ miles east-north-eastward of Pāta Palavarem beacon is the entrance to a small bight formed by the confluence of three rivers 10 of which Varāha river is the westernmost and largest; the entrance to the bight is almost entirely blocked at low water. The south-western entrance point of the bight rises to a plateau 167 feet (50^m9) high, and abreast the village of Rāmbilli, about 4 miles farther east-north-eastward, is a remarkable rounded hill, 606 feet (184^m7) high, 15 surmounted by a beacon, 16 feet (4^m9) in height, which stands on the beach and presents a steep seaward face.

Pūdimadaka.—Anchorage.—Pūdimadaka is a small village consisting mostly of thatched huts, situated on the shore of a bight about 4 miles north-eastward of Rāmbilli beacon with a population in 1936 20 of about 1,800. There is a red stone temple with three towers in the village.

Pillar rock (*Lat.* 17° 29' N., *Long.* 83° 01' E.), 30 feet (9^m1) high, situated about 3 cables offshore south-south-eastward of the village of Pūdimadaka, and some dark cliffs on the coast nearby, show up 25 prominently against the white sandy beaches. There are depths of 5 fathoms (9^m1) close to the seaward side of the rock, and a ledge of rocks lies between it and the coast; this ledge serves as a breakwater during the South-west monsoon, so that vessels can load there in safety during that period.

30 The anchorage during the South-west monsoon is in depths of 5 fathoms (9^m1), with Pillar rock bearing about 214° and the godowns on the beach bearing 282°.

Coast.—Beacon.—Between Pūdimadaka and Dolphin's nose, the coast is rocky but no rock extends more than half a cable offshore; it 35 is backed by a plain studded with hills, some of which have conspicuous patches of drifted sand on their south-western sides. About 4 miles north-eastward of Pillar rock, a rock on the sandy beach appears as a low, black double rock when seen from north-eastward; the adjacent coast on either side of this rock is sandy with a few 40 scattered rocks along the beach. Kutu konda, a prominent small and rocky promontory, 145 feet (44^m2) high, on which stands a beacon, 15 feet (4^m6) in height, is situated about 10½ miles east-north-eastward of Pillar rock.

Pigeon islet, small, rocky and 82 feet (25^m0) high, is situated in a 45 small bay about 5 miles north-eastward of Kutu konda and about half a mile offshore.

Yārāda konda attains an elevation of 1,174 feet (357^m9) about 3 miles north-north-eastward of Pigeon islet; it slopes gradually east-north-eastward towards the coast and terminates abruptly in Dolphin's 50 nose, a bluff headland, 536 feet (163^m4) high, about 4½ miles north-eastward of Pigeon islet. There is a masonry tower and flagstaff on the summit of Dolphin's nose and several houses on its northern side, but the flagstaff is not conspicuous on account of the trees around it. A cave under Dolphin's nose shows up well.

Chart 1711.

Current.—From about August to November the current sets south-westward, and from about the middle of December until July it sets north-eastward at a short distance from the land between Sacramento shoal (page 199) and Bimlipatam (page 210).

From January to April, both inclusive, it attains its greatest rate, which is sometimes as much as 4 knots, in the vicinity of Sacramento shoal and about 5 miles from the land; between Cocanāda and Bimlipatam it extends farther offshore with a lesser rate; inside the 20-fathom (36^m6) line the current is much weaker than that farther offshore, but sometimes close offshore the tidal stream will be experienced. This current also prevails off the coast north-eastward to False point (page 221), but is not so strong as off Cocanāda bay.

Chart 239, plan of Vizagapatam.

VIZAGAPATAM.—**Landmarks.**—Vizagapatam is a port with 15 many natural advantages, situated at the mouth of the Maonderu river which flows into a small bight about 6 cables northward of Dolphin's nose. The best landmarks in Vizagapatam are:—The church, painted white and situated on the summit of Mappin or Ross hill, on the northern side of the river, about three-quarters of a mile north-north-westward of the tower on Dolphin's nose; and the power house chimneys, situated on the eastern side of the turning basin about a quarter of a mile north-westward of the church.

The northern and southern limits of the port are defined by boundary pillars; the southern pillar is situated about 8 cables southward, and the northern pillar about 2 miles north-eastward of the harbour entrance.

Lights. — Beacon. — Signal station. — Storm and weather signals.—Vizagapatam main light is exhibited, at an elevation of 73 feet (22^m3), from a masonry tower, 59 feet (18^m0) in height, situated close within the coast on the northern side of the harbour entrance, about 8½ cables northward of the tower (*Lat.* 17° 41' N., *Long.* 83° 18' E.) on Dolphin's nose.

A light is exhibited, at an elevation of 48 feet (14^m6), from a mast on the outer end of a breakwater on the southern side of the harbour entrance, about 5 cables north-north-eastward of the tower on Dolphin's nose.

A light is exhibited, at an elevation of 185 feet (56^m4), from a steel tower situated about 19 cables north-eastward of Vizagapatam main lighthouse.

A staff surmounted by a ball painted white, stands on Dolphin's nose.

A signal station with a flagstaff is situated close northward of Vizagapatam main lighthouse. The general system of storm and weather signals, *see* pages 30 to 32, is in use at Vizagapatam.

Buoyage.—A light-buoy, painted black and exhibiting a *white flashing light every second*, is moored about 8 cables east-south-eastward of Vizagapatam main lighthouse, and marks the northern side of the entrance channel.

A can buoy, painted red and surmounted by a red cylinder, is moored about 1½ cables southward of the light-buoy and marks the southern side of the entrance channel.

Spoil ground.—Caution.—A spoil ground, which has formed a shoal over which there is a depth of 22 feet (6^m7), is situated about

Chart 239, plan of Vizagapatam.

three-quarters of a mile eastward of Vizagapatam main lighthouse ; during the period January to April it is marked by a conical buoy, painted yellow and black.

- 5 Depths of less than 5 fathoms (9^m1) surround the spoil ground and vessels approaching the port for the purpose of picking up a pilot must keep south-eastward of a line drawn in a 055° direction from a position on the coast about 1½ cables east-south-eastward of the tower on Dolphin's nose.

- 10 **Anchorage.—Prohibited anchorage.**—The best anchorage berth is in depths of from 8 to 9 fathoms (14^m6 to 16^m5), sand, about one mile eastward of the ruins of the Dutch fort, situated on the southern entrance point to the harbour. Vessels requiring to enter harbour should anchor at or close eastward of this position. As stated above, 15 on account of currents and shoaling on the northern side of the entrance channel, vessels should not approach inshore of the anchorage without a pilot. Dredgers are usually at work in the entrance channel.

- A prohibited anchorage indicated on the plan by pecked lines, extends about 1½ miles eastward of Vizagapatam main lighthouse on 20 the northern side of the harbour entrance.

Chart 1711.

- Dolphin's nose, though a remarkable headland when approached from along the coast north-eastward or south-westward, is not readily made out from the high land beyond it, when viewed from a distance 25 seaward. In making Vizagapatam during the North-east monsoon, a vessel should endeavour to sight Rusi hill (page 210) ; from southward she should make Pigeon islet (*Lat. 17° 37' N., Long. 83° 14' E.*). *Chart 239, plan of Vizagapatam.*

- Entrance channel.—Beacons.**—The landlocked harbour of Viza- 30 gapatam is approached by a dredged channel 300 feet (91^m4) wide, which is sheltered by a detached breakwater on its southern side.

- Four pairs of leading beacons, consisting of pylons, have been established for the entrance channel ; the first pair, painted red and white, are in line when bearing 280° ; the second pair, also painted red 35 and white, are in line when bearing 264° ; the third pair, painted black and white, are in line when bearing 281° ; and the fourth pair are in line when bearing about 169°.

- Harbour.—Depths.**—The harbour is open from half an hour before sunrise to half an hour after sunset. To ensure being in time to enter 40 harbour, vessels should be at the anchorage not later than half an hour before sunset.

The harbour consists of a turning basin, three quay berths, one coal- ing and one oiling jetty berth, and four berths at buoys ; in 1951 a concrete coaling wharf was under construction.

- 45 The harbour can be entered by vessels of a draught up to 28½ feet (8^m7) when the tide has risen 2 feet (0^m6) above low water springs. In 1941, the quays and the fueling berth had depths alongside of 30 and 28½ feet (9^m1 and 8^m7), respectively.

- In 1946, it was reported that there was a depth of 33 feet (10^m1) in 50 the dredged part of the entrance channel and alongside the quays.

Pilotage.—Pilotage is compulsory for merchant vessels. Vessels should not attempt to enter the harbour without a pilot who will board at or near the anchorage. H.M. vessels should wait near the anchorage until a berth has been allotted.

Chart 239, plan of Vizagapatam.

Signals.—Only one vessel may enter or leave the harbour at a time. A vessel entering displays numeral pendant 4 of the International Code of Signals, and a vessel leaving displays numeral pendant 1 of the International Code of Signals, but these signals should only be displayed on instructions from the pilot. 5

When a vessel is sighted approaching the port, flag P of the International Code of Signals is displayed at the signal station, and remains displayed until the pilot answers by the entering signal. A vessel waiting to enter should, if numeral pendant 1 of the International Code of Signals or International Code signal, indicating that a vessel is leaving or about to leave the port, is displayed at the signal station, keep well clear of the entrance to allow the outgoing vessel plenty of room. 10

Vessels leaving should display the usual signal for a pilot one hour before the vessel is ready to leave. 15

Town.—Port facilities.—The town of Vizagapatam is the headquarters of the district of Madras state of the same name. Waltair, a suburb, situated on a range of low hills facing the sea about $2\frac{1}{2}$ miles north-eastward of the town, is the residential area. There is a large civil hospital to which seamen are admitted. In 1947, the population was about 70,000. 20

Large stocks of coal and fuel oil are maintained. Coal is embarked alongside the coal jetty or from lighters at the harbour moorings at a rate of about 30 tons per hour. Fuel oil is embarked alongside the oiling jetty at a rate of from 50 to 150 tons per hour. 25

Fresh provisions are available. Fresh water is laid on to the wharves, and can be supplied to vessels at moorings by water boats.

Small repairs to hull, boilers and machinery can be undertaken. There is a dry dock, for details of which, see Appendix I, page 487.

The quays (*Lat. $17^{\circ} 42' N.$, Long. $83^{\circ} 17' E.$*) and jetties are connected with the railway and are fully equipped for handling cargo. There are several cranes of from 3 to 14 tons lifting capacity and there is a 60-ton floating crane. 30

There are three tugs, one of which is equipped for salvage work, and there are several lighters for handling the cargo of vessels berthed at moorings in the harbour. 35

There is regular sea communication with other Indian ports and with Burma.

There is regular air communication with Calcutta and Madras.

The principal exports are :—Manganese ore, ground nut seeds, palmyra fibre and tobacco ; and the chief imports are :—Food grains, machinery, cotton piece-goods and sugar. 40

In 1948-49, 391 vessels of a total tonnage of 1,252,203 entered the port.

Winds.—From October to December north-easterly winds are fresh during the day, with light westerly winds at night. Heavy squalls with rain occur in October and November. See also Climatic table, page 74. 45

COROMANDEL COAST (*continued*).—**Vizagapatam to Bimlipatam.**—**Coast.**—**Beacon.**—Waltair point, about $3\frac{3}{4}$ miles north-eastward of Vizagapatam main lighthouse, is low and sandy with a rocky foreshore backed by red sandhills which, at times, show up well from an offing ; a house in ruins with a grove of palm trees behind it, 50

Chart 239, plan of Vizagapatam.

stands on Waltair point. Foul ground surrounds the point within depths of 8 fathoms (14^m6) and vessels should not anchor near it. *Charts 1711, 1424.*

- 5 From Waltair point the coast trends north-north-eastward for about 12 miles to the mouth of Gostani river. Rusi or Sugarloaf hill, a prominent, round-topped hill, 490 feet (149^m3) high and surmounted by a beacon, is situated close within the coast about 4 miles north-north-eastward of Waltair point. Oppādu bluffs, about 2 miles
10 farther north-eastward, are about 400 feet (121^m9) high, and have the appearance of flat plateaux with steep seaward faces; rocky shoals extend about half a mile offshore in their vicinity. The high land terminates about 4 miles north-north-eastward of Rusi hill and thence, for about 4 miles farther north-north-eastward to the mouth of Gostani
15 river, there are isolated, conical hills. A large sandhill, 314 feet (95^m7) high, lies about midway between Oppādu bluffs and the mouth of Gostani river, and is a prominent mark.

Current.—See page 207.

Chart 1424, plan of Bimlipatam anchorage.

- 20 **Bimlipatam.**—**Beacon.**—**Light.**—The town of Bimlipatam is situated on the south-western side of the Gostani river, the entrance to which is used by native boats but almost dries. The town is built on the north-eastern slopes of a hill, 530 feet (161^m5) high, which is surmounted by a few scraggy trees and by a pyramidal obelisk, 16 feet
25 (4^m9) in height. About half-way up the eastern slope of the hill is a temple, painted white, which shows up well when the sun shines on it. The tall chimney of a factory at Chittivalasa (Chart 1424), about 2½ miles north-north-westward of the town, is also a good mark.

- A light is exhibited at an elevation of 35 feet (10^m7), from a grey
30 masonry tower, 36 feet (11^m0) in height, situated close to the Port office at the north-eastern end of the town, and about 4 cables southward of the boat entrance to Gostani river.

- Storm and weather signals.**—Close south-westward of the light-house is a flagstaff at which storm and weather signals are displayed;
35 the general system, see pages 30 to 32, is in use at Bimlipatam (*Lat. 17° 54' N., Long. 18° 27' E.*).

- Anchorage.**—Anchorage, which is more sheltered than at adjacent ports, may be obtained about one mile offshore, in depths of from 6 to 7 fathoms (11^m0 to 12^m8), sand and mud, with good holding
40 ground. During the South-west monsoon, a vessel should anchor with the lighthouse bearing 264°; during the North-east monsoon, she should anchor with the lighthouse bearing between 249° and 259°.

The tidal stream is scarcely perceptible.

- Town.**—**Port facilities.**—The town stands at the southern end of
45 a large and very shallow backwater formed by Gostani river close within its mouth. The landing place is on the beach between the entrance to the backwater and the Port office at the north-eastern end of the town. Communication with the shore through the surf in ship's boats, is prohibited. In 1941, the population of Bimlipatam was
50 about 9,870.

There are two wharves, each about 150 feet (45^m7) in length, situated on the southern shore of the backwater. Cargo is transported between the wharves and the anchorage by native lighters, of which there are about 25 at the port, each with a capacity of about 2½ tons.

Charts 1711, 1424, 829, 70.

Chart 1424, plan of Bimlipatam anchorage.

Fresh provisions are available and fresh water can be supplied in casks.

There is a Government hospital to which seamen are admitted.

The principal exports are jute, hemp, myrobalans and ground nuts ; 5 and the chief imports are jute and tiles.

There is regular sea communication with Chittagong and occasional sea communication with other Indian ports.

Chart 1424.

Bimlipatam to Kalingapatam.—Coast.—Anchorage.—From 10 the entrance to Gostani river the coast trends north-eastward for about 10 miles to the village of Konāda. This stretch of coast is sandy and is broken about midway by some red cliffs, from 20 to 40 feet (6^m1 to 12^m2) high, which stand out well when seen from seaward during the forenoon when the sun shines on them. Between 15 these cliffs and Konāda, the beach is fringed by rocks extending a short distance seaward.

About 3½ miles north-north-eastward of Bimlipatam lighthouse is Amanām, a prominent flat-topped hill, 833 feet (253^m9) high, smooth and bare, and Kavulavāda (Kaulvada), a hill 246 feet (75^m0) high, 20 stands about 2 miles farther north-eastward.

Konāda is situated near the mouth of a small river, the southern bank of which rises south-westward in bare sandhills to the foothills surrounding Kavulavāda and Amanām ; on the low ground on the north-eastern side of the river are several white buildings and some 25 coconut trees.

Anchorage may be obtained off the river mouth in depths of from 5 to 6 fathoms (9^m1 to 11^m0), sand.

Between Konāda and Kalingapatam, about 37 miles east-north-eastward, the coast is fringed throughout by a sandy beach and is 30 backed by sandhills, from 40 to 60 feet (12^m2 to 18^m3) high ; about 24 miles east-north-eastward of Konāda, the line of the beach is broken by the mouth of Lāngulya river, a broad though shallow stream, which is filled with granite boulders and is only navigable by native boats of shallow draught. 35

Between Konāda (*Lat. 18° 01' N., Long. 83° 34' E.*) and the Lāngulya river, the hills approach the coast in many places, but farther north-eastward, between the river and Kalingapatam, there is an extensive plain on which there are several isolated hills. Kandivalasa, the loftiest and most prominent peak in this locality, lies about 7 miles 40 northward of Konāda and from almost all bearings from seaward, presents a nearly conical appearance. See view facing page 212.

From the mouth of Lāngulya river, the coast trends east-north-eastward for about 12 miles to Sandy point and then turns northward, forming a small bight between Sandy point and the mouth of Vam- 45 sadhāra river, about 2½ miles north-north-eastward ; the town of Kalingapatam stands at the head of the small bight.

Light.—Beacons.—A light is exhibited, at an elevation of 140 feet (42^m7), from a white masonry column, 73 feet (22^m3) in height, situated at Santapilli, about 5 miles north-eastward of Konāda and about half 50 a mile within the coast.

A beacon, 15 feet (4^m6) in height, stands on Rāmachandrapur, a flat-topped hill 538 feet (164^m0) high, situated about 5 miles north-eastward of Santapilli lighthouse.

Charts 829, 70.

Chart 1424.

Pokalapet beacon stands on the eastern side of the entrance to Lāngulya river.

Off-lying dangers.—Santapilli rocks (*Lat.* $18^{\circ} 00' N.$, *Long.* $83^{\circ} 43' E.$), with a least depth of $1\frac{1}{4}$ fathoms (2^m3) over them, lie about $6\frac{1}{2}$ miles south-eastward of Santapilli lighthouse. In fine weather the sea does not break on these rocks, nor is there any discoloured appearance over them but the sea breaks heavily with a moderate swell.

10 Santapilli lighthouse in line with Kandīvalasa, bearing 322° (*see* view on chart 1424) leads about $1\frac{1}{4}$ miles south-westward of Santapilli rocks; and the summit of an isolated, bare, red, and double-peaked hill, 384 feet (117^m0) high, situated about $1\frac{1}{2}$ miles north-north-eastward of Santapilli lighthouse, in line with Kandīvalasa, bearing 304°
15 (*see* view facing this page), leads north-eastward of the rocks.

The channel inside Santapilli rocks may be taken during daylight. At night, vessels should keep in depths of over 20 fathoms (36^m6) when Santapilli light bears between 322° and 290° .

Agra rock, with a depth of $3\frac{1}{4}$ fathoms (5^m9) over it, is situated about
20 one mile offshore and $8\frac{1}{2}$ miles north-eastward of Santapilli lighthouse. The sea is not discoloured over this rock, and rarely breaks on it.

Kandīvalasa, bearing 279° , open southward of Rāmachandrapur beacon, leads about three-quarters of a mile southward of Agra rock.

Currents.—The currents in this vicinity depend principally on the
25 prevailing wind, and run parallel with the coast. The greatest rate observed between Santapilli rocks and the mainland was one knot.

Chart 239, plan of Calingapatam.

Kalingapatam. — Aspect. — Light. — Kalingapatam (Calingapatam) the southernmost port of the Ganjām district, is situated close
30 southward of the mouth of Vamsadhāra river and about $1\frac{1}{2}$ miles north-north-westward of Sandy point. The port consists of an open roadstead, as the entrance to Vamsadhāra river is encumbered with sandbanks and the river is not navigable; the roadstead is, however, protected from south-westward by Sandy point and by a rocky spit
35 which extends about half a cable seaward from that point.

Chart 1424.

The land in the vicinity of Kalingapatam is low and flat, but the locality may be identified by Sālihundām (Sahliundam), an isolated ridge, 409 feet (124^m7) high, running in an east and west direction with
40 its summit near the western end, about 6 miles westward of the town. This ridge is prominent, bare and wedge-shaped and on its eastern slopes are two white temples and a tree. About 4 miles north-eastward of Sālihundām, a low range of jagged, rocky hills commences.
Chart 239, plan of Calingapatam.

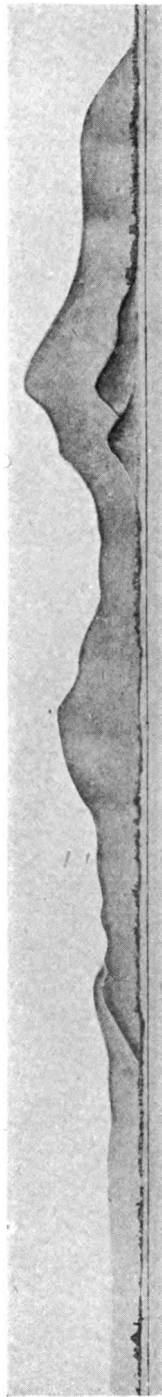
45 A light is exhibited at an elevation of 76 feet (23^m2), from a grey stone obelisk, 73 feet (22^m3) in height, on which there is an outside spiral ladder, painted grey, situated close within Sandy point (*Lat.* $18^{\circ} 19' N.$, *Long.* $84^{\circ} 08' E.$).

The coastal limits of the port are: on the south, the light obelisk;
50 and on the north, the southern end of the village of Ampalam, situated about $2\frac{1}{2}$ miles northward of the light obelisk and about 4 cables northward of the northern side of Vamsadhāra river.

Storm and weather signals.—The general system, *see* pages 30 to 32, is in use at Kalingapatam. These signals are displayed at the

To face page 212.

*Hills in background
obscured by mist.*



Santapilli lighthouse.

*Double-peaked hill, 384 feet (117m) high,
♂ Kandimalasa peak, bearing 304°.*

Clearing mark for Santapilli rocks.
(Original dated 1890.)

Chart 239, plan of Calingapatam.

Port flagstaff, situated at the north-eastern end of the town, about 16 cables northward of the light obelisk.

Dangers.—Obstruction.—Satara reef, a sunken reef which extends about three-quarters of a mile north-eastward of Sandy point, has patches of 30 feet (9^m1) and a least depth of 21 feet (6^m4) at its outer end. The reef is steep-to on its northern and eastern sides, having depths of 42 feet (12^m8), mud, within a distance of half a cable. 5

In 1936, it was reported that considerably less depths than those shown on the chart existed in the roadstead. 10

In 1947, an obstruction, with a depth of 24 feet (7^m3) over it, was reported in a position about 1½ miles north-north-eastward of Sandy point.

Anchorage.—It is reported locally that during the North-east monsoon, vessels usually anchor in depths of about 5 fathoms (9^m1) with the Port flagstaff bearing about 284° and the light obelisk bearing about 205°; and during the South-west monsoon, with the Port flagstaff bearing about 292° and the light obelisk bearing about 202°. It must be borne in mind, however, that the latter berth is less than half a cable from the charted position of the obstruction reported in 1947. 20

Town.—Port facilities.—Kalingapatam was formerly the capital of the ancient Kalinga dynasty and signs of its former greatness are still visible in the ruins of large buildings and the ancient coins which often become exposed after heavy rains. The town and the Port offices and buildings sustained serious damage from a cyclone in 1943, most of which has since been repaired. In 1951, the population was about 5,000. 25

There are no wharves or jetties, and cargo is transported between vessels and the shore in native boats, which, being flat-bottomed, are easily beached. About 40 of these boats are available at the port. 30

Limited supplies of fresh provisions can be obtained.

Until 1941-42, there was a moderately heavy foreign and coastal trade at Kalingapatam, including direct trade with Rangoon, but due to restrictions on the Burmese trade and on the export of ground nuts, the trade has practically ceased and in 1951, there was no appreciable trade at the port. 35

Chart 1424.

Kalingapatam to Bendi creek.—Coast.—Beacons.—Anchor-age.—The coast between Kalingapatam and the village of Bāvanapādu, about 19 miles north-eastward, is sandy and for the first 10 miles is backed by numerous isolated hills which gradually increase in elevation as their distance from the coast increases. The country around Bāvanapādu is low and flat. 40

About one mile southward of Bāvanapādu is a small point off which rocks, about 12 feet (3^m7) high, extend about one cable. A small river, the entrance to which is shallow and entirely closed at low water, flows into the sea about half a mile northward of these rocks. 45

A tall beacon, painted in black and white horizontal bands, stands on the beach at Bāvanapādu (*Lat.* 18° 34' N., *Long.* 84° 21' E.). *Chart 1424 and plan of Pundi river entrance.* 50

A rounded rocky point lies about 7½ miles north-eastward of Bāvanapādu and about one mile farther northward is the entrance to Bendi creek, on the northern side of which, about one mile within the

Chart 1424 and plan of Pundi river entrance.

entrance, is the small village of Nuvalrevu; the village is not visible from seaward, but a white obelisk, the top of which has an elevation of 60 feet (18^m3), with a flagstaff close to it, stands about 2 cables northward of the village and indicates its position. Bendi hills, a flat range, 576 feet (175^m6) high, are situated about 3 miles north-westward of Nuvalrevu. Kidisingi (Khirsinga), a red hill, 169 feet (51^m5) high, rises near the coast, about 1½ miles north-north-eastward of the obelisk.

Anchorage may be obtained off Bendi creek about three-quarters of a mile offshore, with the obelisk bearing about 281°. There is a depth of about 3 feet (0^m9) over the bar at the entrance to Bendi creek and in very fine weather native craft up to about 70 tons can enter the creek and anchor off Nuvalrevu village. Ship's boats can enter the creek with safety at high water when the swell is moderate.

*Chart 1424.***Bendi creek to Baruva. — Coast. — Beacon. — Danger. —**

Between the entrance to Bendi creek (*Lat.* 18° 41' N., *Long.* 84° 27' E.) and the village of Baruva, about 14½ miles north-eastward, the coast is sandy and moderately well wooded and, except close to Baruva where it is flat, rises gradually in elevation.

Ratti (Rati) beacon, an obelisk, 14 feet (4^m3) in height, stands on a double-peaked hill, 342 feet (104^m2) high, situated about 7½ miles north-eastward of the entrance to Bendi creek and about half a mile inland. This hill is the termination of a small range of about similar height which extends to the coast, and is very prominent from north-eastward and south-westward, where, from a distance of 4 or 5 miles, it resembles a headland. In the background the Mahendragiri range, running roughly parallel with the coast about 14 miles west-north-westward of Baruva, has elevations of about 5,000 feet (1524^m0) and is precipitous.

A 6½-fathom (11^m9) rocky patch, with depths of from 9 to 10 fathoms (16^m5 to 18^m3) close around it, lies about 3 miles east-north-eastward of Ratti beacon and about 1½ miles offshore.

Chart 1424, plan of Baruva anchorage.

Baruva.—Light.—Beacons.—The town of Baruva is situated on the northern side of a small river which is shallow and unfit for navigation; very little of the town can be seen from seaward, the Custom house and a few native huts alone being visible owing to the surrounding country being flat and the coast being fringed with coconut trees. A grove of casuarina trees south-westward of the Custom house, is prominent.

A light is exhibited, at an elevation of 35 feet (10^m7), from a grey beacon, surmounted by a triangle, situated close within the beach at Baruva.

Two beacons about 70 yards (64^m0) apart are situated about 1½ cables north-eastward of the light-beacon; they are each 15 feet (4^m6) in height, with an elevation of 65 feet (19^m8); the southern beacon is painted white, and the northern in black and white horizontal bands.

Local reports assert that landing can always be effected except in the heaviest weather and that often, when it would be unsafe to land at Gopālpur (page 216), there is no danger at Baruva. Boats of the Masula type, a kind of surf boat, are always available. Flag B of the International Code of Signals is the signal for a boat.

Like other exposed ports on this coast, Baruva was formerly a

Chart 1424, plan of Baruva anchorage.

commercial port of some importance but most of its trade is now carried by the railway and there has been no sea-borne trade at the port since 1941. Small amounts of fresh provisions may be obtained. In 1951, the population of Baruva was about 10,000. 5

Anchorage.—The anchorage recommended is in depths of about $4\frac{1}{2}$ fathoms (8^m2), sand and mud, with the light-beacon bearing between 304° and 315° .

Chart 1424.

Baruva to Gopālpur. — Coast. — Beacons. — Danger. — The coast between Baruva and Gopālpur, about 29 miles north-eastward, is sandy. About 5 miles northward of Baruva and from 3 to 4 miles inland, there is a small range of bare hills about 600 feet (182^m9) high. Near Kaviti, a village about 10 miles north-eastward of Baruva, the land rises gradually from the coast to an elevation of about 300 feet 15 (91^m4), forming a wooded plateau which is connected with lower ranges of hills farther inland. The higher ranges are so frequently obscured as to be of little use to the mariner.

Charts 1424, 1425.

A masonry beacon (*Lat.* $19^\circ 00' N.$, *Long.* $84^\circ 43' E.$), 21 feet (6^m4) 20 in height, stands on a large sandbank near the coast about 10 miles north-eastward of Baruva light-beacon.

Kaviti (Kowita) beacon stands on the wooded plateau about $2\frac{1}{2}$ miles north-westward of the masonry beacon, at an elevation of 279 feet (85^m0); in 1927, it was reported to be partially obscured by trees. 25

Pīria konda (Ichāpur), a sharp cone, 514 feet (156^m7) high and surrounded by lower hills, stands about $4\frac{1}{2}$ miles northward of Kaviti beacon; Dandrāsi, 676 feet (206^m0) high, stands about $5\frac{1}{2}$ miles north-eastward of Pīria konda. When seen from eastward, Dandrāsi appears as a round-topped hill, but when viewed from southward, it 30 presents a long summit with two peaks, the western of which is slightly the higher. Both Dandrāsi and Pīria konda are good marks.

Chart 1424.

Raegara, a prominent range with four peaks, the highest of which is 2,914 feet (888^m2) high, lies roughly parallel with the coast from 7 to 35 10 miles north-north-westward of Dandrāsi.

Charts 1424, 1425.

Investigator rock, with a depth of $1\frac{1}{2}$ fathoms (2^m8) over it, lies about $8\frac{1}{2}$ miles north-eastward of Baruva light-beacon and about three-quarters of a mile offshore. The water over the rock is not discoloured, 40 neither does the sea break over it.

Sonnāpurampeta (Sonapur) is a small port situated on the northern bank of the Bāhuda river about one mile within its mouth and about $17\frac{1}{2}$ miles north-eastward of Baruva light-beacon. A Custom house with a flagstaff painted black, stands on the beach at Sonnāpurampeta. 45

A white obelisk and a white column, each about 50 feet (15^m2) high, stand about 20 feet (6^m1) apart on an islet close within the mouth of Bāhuda river.

Currents.—Winds.—The currents off the coast between Bimlipatam and Gopālpur between December and June are mainly influenced 50 by the wind, the tidal stream even at springs having very little effect. In December and January, when north-easterly winds prevail, the current about one mile offshore sets steadily south-westward, parallel with the coast, at a rate of one-half to three-quarters of a knot.

Charts 829, 70.

Charts 1424, 1425.

Towards the end of February the wind hauls round south-westward, and in March blows from that quarter, generally being light from west in the morning and backing to south in the afternoon and freshening.

- 5 By the end of January, the current has changed its direction north-eastward parallel with the coast, its rate close offshore being about half a knot, but at 10 miles and upwards offshore, its rate is frequently from 2 to 3 knots.

Chart 1425, plan of Gopālpur.

- 10 **Gopālpur. — Light. — Storm and weather signals.** — Gopālpur, in the Ganjām district and the southernmost port in Orissa state, stands on rising ground, and its white houses, which extend inland for about half a mile, may be seen from a distance of about 12 miles seaward.

- 15 Gopālpur (*Lat. 19° 15' N., Long. 84° 54' E.*) is an open roadstead with no shelter, but landing and shipping operations are possible throughout the year except occasionally when the surf is too high. Ships' boats must not be used for landing, and all transporting between vessels and the shore is effected in native surf boats of the Masula type. A small stream enters the sea close north-eastward of the town but it
- 20 is not navigable even for small boats.

The northern and southern limits of the port are defined by pillars situated about 3 cables north-eastward, and about $4\frac{1}{2}$ cables south-westward, respectively, of the mouth of the small stream.

- Ballast must not be discharged in depths of less than 12 fathoms
- 25 (21^m9).

- A light is exhibited, at an elevation of 149 feet (45^m4), from an iron post on a wooden structure surmounting a small building, the whole painted white and 40 feet (12^m2) in height, situated about 5 cables north-westward of the southern port pillar. The port flagstaff, painted
- 30 white, stands on the eastern side of a building near the coast, about one cable east-north-eastward of the southern port pillar.

The general system of storm and weather signals, *see* pages 30 to 32, is in use at Gopālpur.

- Like other exposed ports on this coast, Gopālpur is no longer visited
- 35 by shipping and there has been no sea-borne trade with the port since 1942. Small quantities of fresh provisions may be obtained.

- Anchorage.—Caution.**—Anchorage may be obtained in a depth of about 45 feet (13^m7), sand and mud, with the port flagstaff bearing 297° and the northern port pillar bearing 357°; or alternatively, at about
- 40 a quarter of a mile south-westward of this position in a similar depth.

In the windy months, April to July, vessels should anchor in a depth of about 54 feet (16^m5) with a good scope of cable.

- There are two patches of hard ground, situated about $6\frac{1}{2}$ cables eastward, and 8 cables south-south-eastward, respectively, of the port
- 45 flagstaff, which should be avoided when anchoring.

- Winds.**—At Gopālpur, the South-west monsoon breaks about 15th June. Winds blow along the coast near the port in March and April; farther northward, these winds are occasional only, and the first intimation of them is the absence of any lull in the sea breeze at
- 50 night. They cause an unpleasant sea for boats, but after blowing for about three days they quickly subside.

Strong winds are frequent off the land between Gopālpur and Pālūru bluff, about 17 miles north-eastward. *See* also Local winds, Circars coast, page 60.

Charts 1425, 829, 70.

Chart 1425, plan of Gopālpur.

Currents.—The currents usually set with the prevailing wind. About the middle of January the north-easterly current begins, and by the middle of February it sets steadily east-north-eastward, running at half a knot close offshore, and increasing to $1\frac{1}{2}$ knots at 12 miles off the coast. At the latter distance its direction is about north-east by east, or inclined towards the land, which should be guarded against. 5

The north-easterly current continues to run until July, when the south-westerly current begins, and gradually strengthens, its rate being sometimes over 2 knots; the south-westerly current continues until about the end of December. Between March and August, owing to the displacement of sand along this coast, all the river mouths have narrow spits trending north-eastward from their entrances. 10

Charts 1424, 1425.

Gopālpur to Puri.—**Sea bed.**—Between Gopālpur and Puri, about 62 miles east-north-eastward, there are no off-lying dangers. Near the coast, the sea bottom is sandy; between depths of 10 and 23 fathoms (18^m3 and 42^m1), it is sand and mud; and in depths of over 23 fathoms (42^m1), it is generally mud. 15

Gopālpur to Ganjām.—**Coast.**—Between Gopālpur and Ganjām, about 12 miles north-eastward, there are several small fishing villages on the coast. 20

Manusurukota (*Lat. $19^\circ 18' N.$, Long. $84^\circ 55' E.$*), an isolated, rocky hill, 177 feet (53^m9) high, is situated about $2\frac{1}{4}$ miles northward of Gopālpur and shows over the coastal sandhills. Two distinctive isolated hills are situated about 8 miles northward, and a similar distance north-north-eastward of Gopālpur. Landābaums, the eastern hill, is 651 feet (198^m4) high and presents a conical, sugarloaf appearance from all directions. 25

Ganjām.—The town of Ganjām is situated on the northern bank of Rushikulya river, close within its mouth, but very little of the town is visible from seaward; the remains of an old fort stand on rising ground on the southern side of the town, but on the northern side of Ganjām the country is low. 30

Rushikulya river is only used for irrigation purposes. 35

Chart 1425.

Ganjām to Puri.—**Coast.**—**Landmarks and beacon.**—Pālūru bluff (Palur bluff), the bold north-eastern termination on the coast of the ranges of the Ganjām district, is 580 feet (176^m8) high and stands about 6 miles north-eastward of the town of Ganjām. This range reaches its greatest elevation in Kujidheppo (Kujidaba) pahār, a saddle-shaped mountain, 1,114 feet (339^m6) high, about 5 miles west-north-westward of Pālūru bluff. The southern end of Chilka lake which is the southernmost part of the Mahānadi river delta, is about one mile northward of Pālūru bluff. 45

Between Pālūru bluff and Chilka mouth, the entrance to Chilka lake about $32\frac{1}{4}$ miles east-north-eastward, the coast consists of low sandhills backed by a little cultivation and grazing ground, but with few marks which can be identified from seaward. A beacon stands on the coast about 13 miles east-north-eastward of Pālūru bluff, but the most prominent mark is a small white stone building on a sandhill close to the sea, about 7 miles farther east-north-eastward. Babeswal temple, painted black and situated about 6 miles west-south-westward of Chilka mouth and about one mile inland, stands amongst trees and 50

Chart 1425.

is only visible from seaward on certain bearings; Harachandi (Harchandi) temple, situated about 10 miles east-north-eastward of Babeswal temple, stands on a sandhill close within the beach. Both
5 of these temples are similar in shape to Puri temple, *see* below, but are much smaller.

Chandikho (Chandiko) pahār, a mountain 1,513 feet (461^m2) high, rises near the western shore of Chilka lake about 16 miles northward of Pālūru bluff; it stands out somewhat from the high ranges west-
10 ward of the lake and presents a summit with two peaks when seen from southward. Dhanai, a prominent sharp peak, 1,893 feet (577^m0) high, situated about 18½ miles north-north-eastward of Chandikho and about 21 miles inland, is a useful mark on a clear day.

Chilka lake.—Chilka lake, a considerable shallow expanse of water,
15 is separated from the sea by a long sandy ridge, in places a little more than a cable wide.

The tidal stream, which rushes through the opening connecting it with the sea, keeps the water brackish during the dry season, from December to June, but when the Bhārgavi and Dayā rivers, which
20 flow into it, come down in flood the salt water is driven out, and it becomes a fresh-water lake.

At the south-western end it is bordered by lofty hills, but northward it disappears in endless shallows, sedgy banks, and islands just above the surface. Nalaban (Nulbunno) island (*Lat.* 19° 41' N., *Long.* 85°
25 18' E.), a reed forest, occupies its centre, and on the eastern side are several islands.

Rambha is a village at the southern end of Chilka lake; it stands about 1½ miles westward of a rounded hill of the same name 511 feet (155^m7) high.

30 Chilka mouth, the entrance to Chilka lake, is small and not easily seen; it has depths of about 3 feet (0^m9) over the bar in the dry season, and probably more during the rains, but the surf is then so high that the entrance is not used. At the entrance, shoals, which break, extend about 4 cables offshore, there being depths of from 6 to 8 fathoms
35 (11^m0 to 14^m6) close outside them; during a period of 50 years from 1840, the entrance moved about 3 miles east-north-eastward.

Chart 1425, plan of Puri.

Puri.—Light.—Puri is one of the most sacred places in the state of Orissa as the famous temple of Jagannāth is situated there. The town
40 stands on a low sandy ridge on the coast about 8 miles east-north-eastward of Harachandi temple; the sea front, on which are some large buildings, is about 3 miles in length.

The Jagannāth temple stands on low ground covered with small trees, near the middle of the town and about 7 cables from the sea,
45 and is surrounded by a high wall. It consists of three circular towers decreasing in size eastward and each crowned by a white dome; the westernmost tower is 192 feet (58^m5) in height and the three towers are in line when seen from eastward. The western side of each tower appears perpendicular while the eastern side slopes. The towers
50 stand out well when seen from seaward during the forenoon.

The port boundary pillars are painted in black and white horizontal bands, the north-eastern pillar is surmounted by a staff and red ball and the south-western pillar by a staff and red triangle.

A light is exhibited, at an elevation of 69 feet (21^m0) from a white

Charts 1425, 829, 70.

Chart 1425, plan of Puri.

pedestal on the parapet wall of the Circuit house, a yellow two-storeyed building marked "Puri" in black, situated at about the middle of the sea front of the town.

The Port office flagstaff stands about $1\frac{1}{2}$ cables south-westward of the Circuit house, the top of the flagstaff having an elevation of 108 feet (32^m9).

Storm and weather signals.—The brief system, *see* pages 30 to 33, is in use at Puri; signals are displayed from the Port office flagstaff. 10

Anchorage.—In fine weather anchorage may be obtained off the town, in depths of from 7 to 8 fathoms (12^m8 to 14^m6), with good holding ground; the best berth is reported to be in a depth of 7 fathoms (12^m8), with the lighthouse bearing 006°, and the south-western port pillar, 321°. The bottom is nearly all clay; the depths decrease 15 gradually from 20 fathoms (36^m6) to 7 fathoms (12^m8), and then rapidly to the beach, so that vessels should sound frequently.

Chart 1425.

An old ballast ground in a depth of 10 fathoms (18^m3), situated about $2\frac{1}{2}$ miles, 121° from the flagstaff, should be avoided. 20

Chart 1425, plan of Puri.

Town.—Port facilities.—Puri (*Lat.* 19° 48' N., *Long.* 85° 49' E.) is a great resort for pilgrims and the Hindu "Car Festival," held annually in June-July, attracts large crowds from all parts of India. The site of the town is salubrious as the monsoon blows over it fresh 25 and cool from the sea, but during the rains it is not so healthy. In 1931, the population was 37,568.

Cargo is transported between vessels at the anchorage and the beach by native surf boats of the Masula type. The usual landing place is close to the Port office flagstaff and ships' boats cannot land even in 30 the calmest weather. Several Masula boats of from 5 to 10 tons capacity, are available.

There is a municipal hospital to which seamen are admitted.

Only small supplies of fresh provisions and fresh water are available.

Like other open ports on the Coromandel coast, the sea-borne trade 35 of Puri has greatly declined of recent years and in 1951, only an occasional native sailing vessel called at Puri.

Chart 1425.

Winds.—The swell on the beach usually gives good warning of the approach of a cyclonic storm. 40

The fine weather season is from the middle of November to the middle of March, when the sea breeze sets in about noon and blows moderately until 2100; the land wind then follows until daylight, after which the wind is variable until noon.

After the middle of February the easterly breeze sometimes lasts 45 all night, and blows freshly for three days, causing a sea which makes boat work inconvenient.

Climatic table.—*See* page 75.

Puri to Devi point.—Coast.—Caution.—Between Puri and Mahānadi point, *see* page 221, about 63 miles east-north-eastward, 50 the bottom is sand in depths under 10 fathoms (18^m3); dark mud, in depths of between 10 and 30 fathoms (18^m3 and 54^m9); and soft grey mud in depths exceeding 30 fathoms (54^m9).

Between Puri and Devi point, about 34 miles east-north-eastward,

Chart 1425.

the coast is sandy with bare sandhills from 20 to 70 feet (6^m1 to 21^m3) high ; eastward of Konārak, a village about midway along this stretch of coast, groups of trees may be seen between the sandhills.

5 Although this coast, like that southward, is so low that it should never be approached after dusk or in hazy weather, yet it is remarkably free from dangers and, by paying proper attention to sounding ample warning will be given. A vessel may proceed along the coast in perfect safety in thick weather, keeping in depths of 12 fathoms
10 (21^m9), but it must be borne in mind that there are depths of 8 fathoms (14^m6) very close outside the breakers. On no account should any reliance be placed on the apparent distance of the coast as, owing to the fine sand haze all objects appear much more distant than they really are. At night the sandy beach blends with the
15 water and the tops of large trees, showing over the hillocks, appear as very distant objects on an indefinite horizon. This is especially the case on moonlight nights, when vessels are tempted to follow the coast closely so as not to miss their ports, which they are apt to do owing to the strong and somewhat uncertain currents.

20 During the South-west monsoon a heavy surf breaks on the coast. Baleswar (Baleswur) temple is a small, black, pagoda-shaped building, with trees round it, situated about half a mile inland about 7 miles north-eastward of Puri ; only the upper part of the temple is visible from seaward. Kushbhadrā river flows into the sea about 14 miles
25 east-north-eastward of Puri ; it is a very shallow stream with breakers across its mouth, but with no dangers off it. Rāmchand (Ramchaudi) temple, a small temple with two palms near it, marks the entrance.

The Sun temple, a famous temple, black and pagoda-shaped, is situated about 3 miles north-eastward of Rāmchand temple and close
30 south-westward of the village of Konārak (Kanarak) ; although in a ruinous state it is very prominent, being about 130 feet (39^m6) high. It stands on low ground with a few trees at its base, presenting the appearance of the gable end of a house with a roof sloping westward ; when seen from north-eastward, it shows as a black pyramid.

35 Tundāha obelisk (*Lat.* 19° 54' N., *Long.* 86° 13' E.), 15 feet (4^m6) high, is situated on a sandhill on the coast about 9½ miles east-north-eastward of Ramchand temple. Prāchī river, a shallow stream, flows into the sea about one mile east-north-eastward of Tundāha obelisk. Nulyasai is a fishing village situated on the sandhills on the coast
40 about 6 miles east-north-eastward of Tundāha obelisk.

Devi river.—Shoal.—Caution.—Devi river is one of the largest branches of the Mahānadī river and is formed by the junction of the Great and Little Devi ; it reaches the sea after passing westward and northward of a long narrow sandspit, which terminates in Devi point.
45 The country within the river entrance is a dense swampy jungle, and is uninhabited.

To a vessel approaching from seaward, the only objects at all conspicuous are Nulyasai village, mentioned above, and Bālijori obelisk, 15 feet (4^m6) high, situated on the sandhills about 2½ miles north-
50 north-eastward of Devi point. On closing the river, the breakers on the bar may be seen and, from aloft, the river is visible over the sandspit.

During the South-west monsoon, the entrance probably breaks right across.

Charts 829, 70.

Chart 1425.

Central sand, the outer bank off the river mouth, lies about $1\frac{1}{2}$ miles north-eastward of Devī point and the sea does not always break on it in fine weather. This bank, which extends about one mile seaward from the line of the coast, was reported in 1942 to have extended about one mile farther south-eastward. A 3-fathom (5^m5) patch lies about $1\frac{1}{2}$ miles southward of Devī point and about three-quarters of a mile offshore. 5

In case of necessity during southerly winds only, there is a landing place for boats in a bight northward of Central sand, about 13 cables northward of Devī point. 10

Vessels coasting should keep in depths of not less than 9 fathoms (16^m5); Bālijori obelisk bearing less than 315° leads north-eastward of the reported extension of Central sand.

Anchorage.—Caution.—Small steamers with local knowledge and of not more than 10 feet (3^m0) draught, may obtain good anchorage in depths of 3 fathoms (5^m5) inside the mouth of Devī river, with Devī point bearing 057° , distant about 6 cables. 15

Vessels with local knowledge may also obtain anchorage off the mouth of Devī river, eastward and north-eastward of Devī point. During onshore winds, the anchorage is in depths of 8 fathoms (14^m6) with Bālijori obelisk bearing 317° distant about $1\frac{1}{2}$ miles; during westerly winds the usual anchorage is about one mile southward of this position, but in view of the reported extension south-eastward of Central sand, great care should be exercised and constant sounding is necessary. 20 25

Devī point to Makānādī point.—Coast.—Between Devī point and the entrance to Jatādhārmohan (Jotdar) river, about 17 miles north-eastward, the coast consists of a low sandy beach with hillocks from 15 to 20 feet (4^m6 to 6^m1) high. At two places the coast is so low that it is probable that in heavy weather the sea washes over it into the backwater behind. 30

At about $1\frac{1}{2}$ miles north-eastward of Bālijori obelisk is the shallow mouth of the Harishpurgarh branch of the Devī river, but the entrance cannot be distinguished from seaward. The mouth of Jatādhārmohan river is shallow and there are always breakers across it; in 1889, the position of the mouth was marked by a ridge of high sandhills, between one and 2 miles westward of it. About 6 miles east-north-eastward of the mouth of Jatādhārmohan river is the entrance to Patakund river which is also very shallow. North-eastward of Patakund river the land is very low. 40

Chart 755.

Mahānādī point, about 7 miles north-eastward of the entrance to Patakund river, is the north-eastern extremity of an island situated in the mouth of Mahānādī river and dividing it into two entrance channels. 45

Light.—False point light (Lat. $20^\circ 20' N.$, Long. $86^\circ 44' E.$) is exhibited, at an elevation of 127 feet (38^m7), from a reddish-brown stone tower, 132 feet (40^m2) in height, with a large white ten-pointed star on its south-eastern side, situated within the northern entrance to Mahānādī river, and about $1\frac{1}{2}$ miles westward of Mahānādī point. 50

Caution.—In January, February and March, the light is occasionally obscured by fog on the land, which sometimes causes it to show a deep red colour; during these months, vessels should sound

Chart 755.

frequently when approaching False point, and should not proceed into a depth of less than 11 fathoms (20^m1), which depth is about 3 miles offshore. A good guide is to examine the bottom, and if it is sand mixed with mud, *see* page 219, the vessel's head should be kept seaward till daylight.

Charts 755, 1425.

Mahānadi river.—Mahānadi river has a course of about 510 miles and receives many tributaries.

10 The southern entrance is about 4½ miles north-eastward of the entrance to Patakund river, and the northern entrance is about 3 miles farther north-eastward and about 1½ miles eastward of False point lighthouse. In 1889, a long line of heavy surf extended right across, and about one mile seaward of both entrances.

15 The land at the entrance to the river and near False point lighthouse is low and intersected by numerous creeks and the action of the surf forms long narrow islands joined by shoal ground, which are constantly altering in shape.

Chart 755.

20 **Nurrea Banga Nassi.**—A tongue of land extends about 3½ miles north-eastward from False point lighthouse, a part of it nearly meeting Turtle point (*Lat.* 20° 22' N., *Long.* 86° 47' E.), the southern extremity of Nurrea Banga Nassi, an island which extends about 4½ miles northward and is sometimes joined to the mainland; a drying spit extends
25 about three-quarters of a mile westward from its northern end. The seaward coast of the tongue of land and also of Nurrea Banga Nassi, consists of small sand hillocks, from 6 to 8 feet (1^m8 to 2^m4) high, and covered with grass and scrub.

False Point anchorage.—The anchorage northward of Nurrea
30 Banga Nassi, and in the bay westward of its northern part, is known as False Point anchorage. The anchorage in the bay is safe, but it is very shallow, and is gradually silting up.

Reddie point is the western end of the spit which extends westward from the northern end of Nurrea Banga Nassi; its position is
35 continually changing.

The refuge house, a large stone building with a flagstaff, and a few coconut palms at Hukitola, stand at about the middle of the western side of Nurrea Banga Nassi; the house is easily distinguished from seaward.

40 The southern shore of the bay, westward of Nurrea Banga Nassi, embracing Plowden island, the entrance to Jambu river, and towards Temple point, is principally mangrove swamp. Temple point (*Lat.* 20° 25' N., *Long.* 86° 44' E.) is covered with trees; a remarkable tree, known as Temple tree, the highest in the vicinity, stands about
45 one mile west-north-westward of the point.

Jambu location, consisting of a bungalow and some ruins of houses, is situated on the east bank of Sunta creek, about a mile west-south-westward of Temple point. Between Temple point and the entrance to Kandrapatia (South Broni) river, about 3½ miles northward, the land
50 is low, covered with grass and scrub with occasional patches of mangrove swamp, and fringed with sand which forms the high water line.
Charts 1425, 814.

Farther northward the sandhills are more elevated, and the mouth of Hānsuā river (Broni Mohan creek), about 1½ miles north-eastward of

Charts 1425, 814.

the entrance to Kandrapatia river, forms a prominent gap between high sandhills.

Chart 755.

Channels.—Caution.—Two channels, which have a common entrance northward of Reddie point, and a common bar westward of it, over which there are depths of from one to 5 feet (0^m3 to 1^m5), lead inland; small craft with local knowledge can enter without difficulty at high water.

Kharnāsi river (Bakud creek), the southern channel, is a short branch of the Mahānadi river, and has depths of from one to 5 feet (0^m3 to 1^m5).

Jambu river, the northern channel, which leads to Jambu location, has depths of from 6 to 20 feet (1^m8 to 6^m1) in mid-channel, and is available, at high water, for vessels of 10 feet (3^m0), draught.

The channels are liable to change and to silt up, and the depths given above have not been checked since the port was closed, in 1924.

Anchorages.—The outer anchorage is in a depth of about 26 feet (7^m9), about three-quarters of a mile northward of the northern point of Nurrea Banga Nassi; or in a depth of about 33 feet (10^m1) about a mile farther north-north-eastward.

Small vessels, with local knowledge, can anchor in a deep depression, nearly 1½ miles long, situated southward of Reddie point, and westward of the spit, the depths being from 7 to 14 feet (2^m1 to 4^m3).

Tidal streams.—Currents.—The tidal streams within the harbour set fairly through the several channels, and the rate at springs averages 2 knots. After heavy rains, when the freshets come down Kharnāsi and Jambu rivers, the ebb stream, which runs out round Reddie point, sometimes attains a rate of 4 or 5 knots.

In the offing, the tidal stream sets north-eastward with the rising tide and south-westward with the falling tide, at a rate of about one knot in each direction. The rate, however, is much influenced by the prevailing wind, so that during the South-west monsoon, the north-easterly stream, together with the current, sometimes attains a rate of 4 knots.

Directions.—Vessels from southward having made False point lighthouse should keep in depths of at least 10 fathoms (18^m3) until the lighthouse (*Lat.* 20° 20' N., *Long.* 86° 44' E.) bears 248°, distant about 6 miles, when they should make good a course of 001° until the refuge house is abeam, whence they should make good a 329° course towards the anchorage. With strong southerly winds the tidal stream with the rising tide sets towards the coast in the vicinity of Satbhaya (Satbaia) sandhill (chart 814), situated about 13½ miles north-eastward of Reddie point, and vessels from northward must guard against it.

With a strong flood stream setting into False point anchorage, it is best to approach the outer anchorage on a southerly course, turning eastward and north-eastward so as to stem the stream before anchoring. Steam vessels steering towards Reddie point, and attempting to turn to starboard, or through south-west and north-west, with the flood stream running, have been rapidly swept across the channel westward, and grounded on the shoals extending from Temple point.

Small craft proceeding into the inner anchorage must guard against an eddy which extends from Reddie point to depths of 3 fathoms (5^m5). It must be remembered that Reddie point does not always show, as the spit, of which it is the extremity, dries only about 4 feet (1^m2).

Charts 1425, 814, 829, 70.

Chart 755.

Boat channels, winding through mudbanks, lead from the inner anchorage to Kharnāsi and Jambu rivers.

Chart 814.

- 5 **Nurrea Banga Nassi to Maipura point. — Coast. — Offshore depths.**—False bay is entered between the northern end of Nurrea Banga Nassi and Maipura (Maipara) point, the south-western entrance point of Maipura (Maipara) river, about 21 miles north-eastward. The coast between the mouth of Hānsuā river and Maipura point
10 consists of sandhills and is moderately high, but northward of Maipura river the land is flat.

Satbhaya sandhill, 60 feet (18^m3) high and situated about 4½ miles south-westward of Maipura point, has a solitary clump of bushes at its north-eastern end and is a good mark.

- 15 In the southern part of False bay, the bottom is soft olive-green mud and the depths decrease regularly to the shore. In the northern part of the bay, however, the bottom changes from soft mud to a mixture of sand and mud and, towards the edge of the sandbanks which extend about 11 miles east-north-eastward of Maipura point,
20 broken stones and rotten shells are found in addition.

- A bank on which the depths are less than 20 fathoms (36^m6) extends from about 20 to 35 miles offshore in the eastern approaches to False bay. Near the outer edge of this bank, about 30 miles eastward of Maipura point, is the Pilot's Ridge, a nearly level ridge on which there
25 are depths of from 17 to 19 fathoms (31^m1 to 34^m7), sand, shells and speckled stones.

- When approaching False point from eastward the depths decrease gradually but when approaching Palmyras shoals, *see* below, from the same direction, they decrease abruptly from 13 to 9 and 4 fathoms
30 (23^m8 to 16^m5 and 7^m3).

Chart 754.

- Maipura river.—Off-lying islands and dangers.**—Maipura river, the southern branch of the Brāhmanī river, enters the sea between Maipura point and the coast about 2½ miles west-north-west-
35 ward; it is deep but its entrance is blocked by flats which can only be crossed by boats at half tide and in smooth water.

- Long sand, a drying shoal in two parts, on which the sea breaks heavily, extends about 3½ miles north-eastward from a position about three-quarters of a mile east-north-eastward of Maipura point; the
40 two parts of the shoal are separated by a channel about 3 cables wide with depths in it of from 1½ to 8 fathoms (2^m3 to 14^m6), which leads to the entrance to Dhāmra river, *see* below. The north-eastern part of Long sand is separated from another shoal north-eastward on which stands Shortt island (*Lat.* 20° 47' N., *Long.* 87° 05' E.) by a channel
45 about 2½ cables wide, with depths in it of from 2½ to 5 fathoms (4^m1 to 9^m1), which also leads to Dhāmra river.

- The Wheeler islands are six small islands which are situated on Long sand; the two largest islands of the group, 15 and 20 feet (4^m6 and 6^m1) high, lie on the north-eastern part of the shoal, and
50 the four remaining islands, the largest of which is 20 feet (6^m1) high, lie on the north-western end of the south-western part of Long sand.

The entrance channel to Maipura river lies between Maipura point and the south-western extremity of Long sand.

Charts 814, 829, 70.

Chart 754.

Palmyras shoals, with depths over them of from 3 feet to 5 fathoms (0^m9 to 0^m1), extend eastward and north-eastward of Long sand to a distance of about 10 miles east-north-eastward of Maipura point.

Tidal streams.—The tidal streams set over Palmyras shoals at a rate of 2 knots at springs. On the north-eastern side of the shoals, the tidal stream sets north-westward with the rising tide, and south-eastward with the falling tide; at the southern end of the shoals, the stream sets northward with the rising tide and southward with the falling tide.

Anchorage.—Anchorage may be obtained in a depth of 7 fathoms (12^m8), mud and sand, with strong north-westerly winds, about 2½ miles south-eastward of the northern end of the sandhills on Maipura point.

Maipura point to Balisahi point.—Coast.—Beacons.—Palmyras point, situated about 5½ miles north-westward of Maipura point, is the north-eastern extremity of the low land which separates the mouths of Maipura and Dhāmra rivers, and is the south-eastern entrance point of the latter river; the point is covered with dark jungle and is difficult to distinguish, the surrounding land being low with a few palmyra trees. A mudbank, which dries for a distance of about 2½ miles offshore, fronts this stretch of coast.

Budarā beacon, a black framework beacon, surmounted by a ball and 80 feet (24^m4) in height, stands on the coast about 1½ miles south-south-eastward of Palmyras point.

The entrance to Dhāmra river lies between Palmyras point and a low mud point about one mile north-westward. Chāndnipāl beacon, a red and white framework beacon surmounted by a ball and 80 feet (24^m4) in height, stands on the coast about one cable northward of the low mud point.

From Chāndnipāl beacon, the coast trends northward for about 4½ miles to Balisahi point and is fronted by shallow flats which extend as much as 6 or 7 miles offshore. The southern portion of these flats, known as Kanika sand, consists of extensive drying sand and mud flats which form the northern side of the approach channel to Dhāmra river.

Balisahi beacon, a black framework beacon surmounted by a ball and 80 feet (24^m4) in height, is situated about 3 cables within the coast about 1¾ miles southward of Balisahi point; this beacon, and also Budarā and Chāndnipāl beacons, are all visible from seaward but are not easy to pick up from outside the shoals.

Dhāmra river.—Off-lying islands.—Light.—Dhāmra river, the most important of the rivers in the state of Orissa, forms the northern exit for the confluence of the Brāhmanī, Kharsuā and Baitarani.

Dakshindhāmra (Dakshina Dhāmra) village (*Lat.* 20° 48' N., *Long.* 86° 54' E.), on the northern bank about 4 miles above the entrance, consists of a few straggling houses. Matai nāla, a river which joins Dhāmra river from northward about half a mile above the village, is about one cable wide and is reported to be navigable at low water for vessels of a draught of 8 feet (2^m4).

Shortt island, situated about 5½ miles eastward of Palmyras point, is 10 feet (3^m0) high and is the largest of four small islands which lie on a drying shoal, which extends about 1½ miles eastward and one mile westward of it, and is continually changing its shape; in 1933, the northern end of Shortt island was being washed away and the southern

Chart 754.

end was extending. Of the other islands on this shoal, two lie about 5 and 9 cables, respectively, north-westward of the southern end of Shortt island, and the remaining island, which is 8 feet (2^m4) high, 5 lies about one mile north-eastward of the same point.

A light is exhibited, at an elevation of 62 feet (18^m9), from a white stone tower, 60 feet (18^m3) in height, situated about three-quarters of a mile northward of the southern end of Shortt island.

Entrance channel.—Buoys.—The outer end of the buoyed entrance channel to Dhāmra river lies about 1½ miles north-north-westward of Shortt Island lighthouse and in 1942 had a least depth of 5 feet (1^m5) over the outer bar; at the same date there was a least depth of 8 feet (2^m4) between the south-eastern extremity of Kanika sand and the northern edge of the mud flat extending eastward from 15 Palmyras point. In 1934, that part of the drying shoal lying on the northern side of Shortt island was reported to be extending northward, and in 1933, the south-eastern extremity of Kanika sand was reported to be extending south-eastward.

The outer bar of the river, situated north-north-westward of Shortt 20 island, maintains its position and depths moderately well but the inner bar, situated southward of Kanika sand, changes both in depth and position.

Close within its mouth, Dhāmra river is divided into two channels by Kalibhanj Diān, a narrow island lying parallel with the river 25 banks between East point, its eastern extremity, situated about one mile south-westward of Chāndnipāl beacon, and West point, its western extremity, about 5 miles farther westward. The channel northward of the island is the navigable channel; in 1942, there was a least depth of 17 feet (5^m2) in the fairway across Chāndnipāl bar, situated in the 30 channel northward of Kalibhanj Diān, about 1½ miles westward of East point.

A conical buoy, painted in black and white chequers, marked “ F W Y ” and surmounted by a pole with a bamboo basket, is moored about 2¼ miles north-eastward of Shortt Island lighthouse.

35 A can buoy, painted black and marked “ E ”, is moored at the inner end of the outer bar, about 1½ miles north-westward of Shortt Island lighthouse; it marks the southern side of the channel at the point where the latter makes an abrupt turn southward to pass between Kanika sand and the shoal extending westward from Shortt island.

40 A can buoy, painted black and marked “ e ”, is moored about 7 cables southward of “ E ” buoy.

A conical buoy, painted red, marked “ D ” and surmounted by a ball, is moored about 7 cables eastward of the south-eastern extremity of Kanika sand and about 11 cables westward of Shortt Island light- 45 house.

A conical buoy, painted red, marked “ C ” and surmounted by a ball, is moored on the northern side of the channel, about 2¾ miles westward of Shortt Island lighthouse.

A conical buoy, painted red, marked “ B ” and surmounted by 50 a ball, is moored on the northern side of the channel, about 2¼ miles east-south-eastward of Chāndnipāl beacon (*Lat.* 20° 47' N., *Long.* 86° 58' E.).

A conical buoy, painted red, marked “ A ” and surmounted by a ball, and a conical buoy, painted black, are moored on the northern

Chart 754.

and southern sides, respectively, of the channel, about 7 and 8 cables southward of Chāndnipāl beacon.

A can buoy, painted black and surmounted by a ball, is moored on the south-eastern side of the channel, about 2 miles west-south-westward of West point.

Baitaranī river flows into Dhāmra river between North point, about $3\frac{1}{4}$ miles south-westward of West point, and South point, about 6 cables farther southward; both North and South points are marked by beacons. A conical buoy, painted red and a can buoy, painted black, each surmounted by a ball, are moored about $1\frac{1}{4}$ cables eastward, and $2\frac{1}{4}$ cables south-eastward, respectively, of the beacon on North point.

Pilotage.—Native pilots are available at Chāndbāli, *see* below, and will meet vessels at Shortt island by previous arrangement. Pilotage is not compulsory but if entering the river it is advisable for strangers to take a pilot as the inner bar is subject to change and the buoys are moved occasionally. It is inadvisable for any vessel to proceed above Dakshindhāmra village without a pilot.

Anchorage.—**Directions.**—There is anchorage off the outer bar near the entrance to the approach channel to Dhāmra river, about 4 miles north-eastward of Shortt island, in depths of about 7 fathoms (12^m8). During strong south-westerly winds, a good berth is in depths of 7 fathoms (12^m8), with Shortt Island lighthouse bearing 206° .

When rounding Palmyras shoals, vessels from southward should keep in depths of not less than 15 fathoms (27^m4) until Shortt Island lighthouse bears less than 237° , when they may approach Shortt island on that bearing. If anchoring at the outer anchorage, vessels should approach the anchorage with Shortt Island lighthouse bearing 226° and, if at night, should anchor when in depths of 6 or 7 fathoms (11^m0 or 12^m8).

Charts 754, 829.

River above Dakshindhāmra.—At about 10 miles above its mouth, Dhāmra river divides into two branches; the Baitaranī, on which stand the towns of Chāndbāli, *see* below, and Jāipur, situated about 4 and 28 miles, respectively, westward of its junction with Dhāmra river; and the Brāhmanī, a tributary of which leads to Cuttack, about 55 miles west-south-westward of the junction.

Chart 754.

Baitaranī river.—From its source, Baitaranī river flows in a south-south-easterly direction to Jāipur and thence in an east-south-easterly direction to its junction with Dhāmra river; beacons stand at various points on the banks and buoys mark the navigable channel.

In 1942, the least depth in the channel across Jhuta bar, situated at the junction of Baitaranī river with Dhāmra river, was 7 feet (2^m1). The maximum draught of vessels trading with Chāndbāli is about 13 feet (4^m0); vessels of $14\frac{1}{2}$ feet (4^m4) draught could reach that port at high water, springs, and of 12 feet (8^m7) at high water, neaps, but only those vessels with local knowledge should use this river.

Chāndbāli. — **Port facilities.** — **Anchorage.** — Chāndbāli (Lat. $20^\circ 46' N.$, Long. $86^\circ 44' E.$) is situated on the northern bank of Baitaranī river, about 8 miles above its junction with Dhāmra river. The sea-borne trade of the town, which is mainly with Calcutta and is of growing importance, has practically superseded that of Balasore (page 230).

Charts 814, 829, 70.

Chart 754.

There is a jetty at Chāndbāli with depths alongside of about 15 feet (4^m6) ; passengers and cargo are usually embarked and discharged alongside the jetty. There is a large passenger traffic between Chānd-
5 bāli and Calcutta.

The main export is rice and the chief imports are gunny bags, cotton piece-goods, salt and kerosene. There is a Port and Customs office.

There is regular sea communication with Calcutta.

Vessels with local knowledge may obtain anchorage in mid-stream
10 off the town of Chāndbāli, in depths of from 27 to 40 feet (8^m2 to 12^m2).

Storm and weather signals.—The brief system, *see* pages 30 to 33, is in use at Chāndbāli.

Charts 814, 829, 70.

CHAPTER VI

BALISAHI POINT TO ELEPHANT POINT, INCLUDING THE HOOGLY RIVER AND THE SUNDARBANS

Chart 814.

COROMANDEL COAST (*continued*). — **Balisahi point to Burhābalang river entrance.**—**Coast.**—Between Balisahi point and the entrance to Burhābalang river, about 37 miles northward, the coast trends north-north-westward and then north-eastward, forming a wide bight. Between Balisahi point and a position about 13 miles north-north-westward abreast the village of Bideipur, the coast is low, muddy and covered with small scrub. Landing on this part of the coast is difficult owing to the softness of the mud. Between Bideipur and Kulikhati (Kalikoti), about 8 miles northward, the coast is flat and fronted by low mangroves. Gamai river, small and at low water inaccessible to any but small boats, enters the sea about three-quarters of a mile southward of Kulikhati. From Kulikhati, the coast trends north-north-eastward for about 11 miles to Nauri (*Lat. 21° 19' N., Long. 86° 54' E.*) and thence north-eastward for about 10 miles to Chandipur; on the latter stretch the coast becomes firmer with higher trees and sandhills. A small stream, similar to Gamai river, enters the sea about one mile southward of Nauri, and about midway between Nauri and Chandipur and about 2 miles inland, is a large double pagoda which shows amongst the trees on north-westerly bearings.

Between Chandipur and the entrance to Burhābalang river, about 2 miles north-eastward, the coast consists of low sandhills, and, from an offing, the locality appears sandy and barren. A black flagstaff stands on the coast about 6 cables north-eastward of Chandipur.

The shore of the bight between Balisahi point and the mouth of Burhābalang river is fronted by drying sand and mud flats, outside which a bank on which the depths are less than 3 fathoms (5^m5), soft olive-coloured mud, extends as much as 5½ cables seaward of the edge of the mangroves at Kulikhati.

Balasore road.—**Anchorage.**—**Directions.**—Balasore road, with depths in it of from 3½ to 5½ fathoms (5^m9 to 10^m5), is situated south-eastward of the mouth of Burhābalang river.

Vessels of a draught of about 20 feet (6^m1) will find the best anchorage in depths of about 4 fathoms (7^m3), sand and stiff mud, good holding ground, with Chandipur flagstaff bearing 312°, distant 5½ miles; or, depending on draught, closer inshore on the same bearing.

Vessels should approach the anchorage keeping the highest part of Nilgiri mountain, situated about 16 miles westward of the mouth of Burhābalang river, bearing about 293°.

Charts 829, 70.

Chart 814.

Tidal streams.—The tidal streams in Balasore road set south-westward during the falling tide and north-eastward during the rising tide ; the rate of each stream is about 2 knots at springs.

- 5 **Burhābalang river.**—**Caution.**—Burhābalang river rises in the Mayurbhanj (Morbhanj) hills and, after receiving the Gangahar and Sunai tributaries, flows into the sea at Balasore road.

Chart 239, plan of Balasore road and Burhabalang river.

- The river is tidal for a distance of 23 miles and native craft and
10 vessels of 9 feet (2^m7) draught navigate to Koila Ghāt, about 4 miles from the entrance.

The entrance to the river is almost closed by a bar, which extends about 2½ miles seaward. There is a narrow channel into the river.

- The bar is liable to deteriorate during the South-west monsoon, and,
15 with south-easterly winds, breaks right across. The last quarter of the flood is the best time for crossing.

- Great caution must be used in taking the bar, as the channel is always liable to shift, and when crossing the bar, if the flood stream is running, a vessel must guard against being set northward. Local
20 knowledge is necessary for entering the river.

In the river, the ebb stream lasts 8 or 9 hours, and runs at a rate of as much as 4 knots ; the flood stream is feeble, averaging about half a knot.

- Balasore.**—The town of Balasore is situated on the southern bank
25 of the river, about 16 miles above its mouth. The port comprises the water front abreast the town at which there is a wharf ; small boats are used for transporting cargo between vessels and the wharf. There are depths of 10 feet (3^m0) in mid-stream abreast the Custom house (Lat. 21° 30' N., Long. 86° 56' E.), but the river here is only about half
30 a cable wide.

There is a hospital in the town to which seamen can be admitted. In 1931, the population of Balasore was 17,843.

- Although Balasore was formerly a port of some commercial importance, practically all imports and exports now travel by rail and in
35 1951, there was no sea-borne traffic at the port.

Chart 814.

- Balasore roadstead is in the track of cyclonic storms and many disasters have been caused by them. Vessels in doubt as regards weathering a storm might run farther south-westward and anchor off
40 Kulikhathi where the bottom is soft mud and shoals gradually.

- Burhābalang river entrance to Rasūlpur river entrance.**—**Coast.** — **Anchorage.** — **Dangers.** — From the mouth of Burhābalang river, the coast trends east-north-eastward for about 51 miles to the mouth of Rasūlpur river, situated on the western bank at the
45 mouth of the Hooghly river ; for the first 25 miles or so of this stretch there are several sandhills, but farther eastward, the coast is low and without any distinctive landmarks.

- Pāñchpāra river enters the sea about 4½ miles north-eastward of the mouth of Burhābalang river, and near its mouth are some mottled grey
50 and yellow sandhills. A bar, on which there are depths of one foot (0^m3), obstructs its mouth, but within the entrance the depths increase and native craft of up to 100 tons can enter the river and ascend to Mahadini, about 9 miles inland.

The entrance to Subarnarekha river lies about 13 miles east-north-

Chart 814.

eastward of the mouth of Pānchpāra river. Pippli sand which dries, lies about 2 miles south-south-eastward of the entrance to Subarnarekha river; the entrance channel, which nearly dries, passes on the south-western side of Pippli sand. Within the entrance the river is reported to have moderate depths and to be navigable by native craft for about 16 miles, for which distance it is tidal and studded with islands. The former port of Subarnarekha, which is almost choked with sandbanks, is situated at the mouth of the river and is visited by fishing boats; a pagoda and a grove of trees stand on the western bank near the entrance.

There is anchorage off the entrance to Subarnarekha river, in depths of from $4\frac{1}{2}$ to 5 fathoms (8^m2 to 9^m1), mud, with the pagoda bearing 327° , distant about 8 miles.

Two shallow streams, Digwah Mohan and Munder Mohan, enter the sea about 12 and 16 miles, respectively, east-north-eastward of the mouth of Subarnarekha river. Between the entrance to the latter and the mouth of Rasūlpur river, about 16 miles north-eastward, are several creeks of which Pichāboni khāl (Sola creek), about 6 miles east-north-eastward of Munder Mohan, is the largest. Kaukhāli tower (*Lat.* $21^\circ 50' N.$, *Long.* $87^\circ 57' E.$), a disused lighthouse of white brick, 80 feet (24^m4) in height, stands about 4 miles north-eastward of the entrance to Rasūlpur river.

A bank on which the depths are less than 3 fathoms (5^m5) fronts the whole stretch of coast between the mouths of Burhābalang and Rasūlpur rivers, and, southward of Digwah Mohan, extends as much as 10 miles offshore; heavy breakers occur here in bad weather.

Jensen sand, the inner part of which dries, extends about 8 miles south-south-westward from the mouth of Rasūlpur river, and Spence sand, which dries in places, extends about 7 miles south-south-westward from the extremity of Jensen sand. Western Sea reef, a spit on which the depths are less than 3 fathoms (5^m5), extends about 19 miles southward from the southern extremity of Spence sand.

The small craft which frequent Rasūlpur river, when approaching from westward, use a narrow channel close inshore which has depths of only a few feet and requires local knowledge.

APPROACHES TO HOOGLY RIVER.—The entrance to Hooghly river lies between the coast about 6 miles south-westward of the mouth of Rasūlpur river and the south-western extremity of Sāgar island, about 13 miles east-south-eastward; Sāgar Island lighthouse stands about three-quarters of a mile within the south-western extremity of the island. In 1952, the main entrance to Hooghly river was through Western channel, the entrance to which is marked by Western Channel light-vessel, situated about 42 miles southward of Sāgar Island lighthouse.

Chart 829.

Outlying banks.—In 1914, a bank with depths of 19 fathoms (34^m7), fine yellow sand, over it, was reported by S.S. *Sidra* in lat. $20^\circ 15' N.$, long. $88^\circ 03' E.$

Chart 814.

Sounding on the Pilot's ridge (page 224) affords an excellent guide when approaching Hooghly river as on this bank in depths of less than 20 fathoms (36^m6), the bottom is shell, sand and gravel of a reddish

Chart 814.

colour, while in depths of more than 23 fathoms (42^m1) it is sand and mud with shining specks, or olive-coloured mud with broken shells. The south-eastern edge of this ridge is rather steep, the depths close off this edge being from 28 to 30 fathoms (51^m2 to 54^m9).

Light-vessel.—Buoys.—Western Channel light-vessel, painted red with “Western Channel” in white letters on the sides, has one mast with the lower half of a black ball as topmark, and is moored about 22½ miles south-eastward of the southern extremity of Western Sea reef, and about 42 miles southward of Sāgar Island lighthouse. A light is exhibited, at an elevation of 42 feet (12^m8) from a light-structure situated amidships; in addition to the characteristic light, the vessel exhibits a *white flashing riding light*, showing *one flash every second*.

A fog signal is sounded from the light-vessel.

15 A station buoy, painted in red and white vertical stripes and surmounted by a black framework basket is moored about 2½ miles south-eastward of Western Channel light-vessel.

A conical station buoy, painted in black and white vertical stripes and surmounted by a red framework basket, is moored about 41 miles south-south-eastward of Sāgar Island lighthouse and about 2 miles east-south-eastward of the former position of Eastern Channel light-vessel, now withdrawn.

Pilotage.—Pilotage is compulsory for all merchant vessels of over 100 tons, and no vessel should attempt to navigate the Hooghly river without a pilot.

The maximum draught for vessels that can be taken up the river at springs, in normal circumstances, is 28 feet (8^m5), and at neaps 26 feet (7^m9). Vessels of over 29 feet (8^m8) draught can be taken up the river, but special arrangements must be made and the date selected by the Port Pilotage office. See also page 236.

Pilot vessel.—Lights.—Signals.—A steam pilot vessel, painted white with one mast and a yellow funnel, cruises in the vicinity of a position 49½ miles southward of Sāgar Island lighthouse and about 5 miles southward of Western Channel light-vessel; this cruising station is known as the Sandheads. In very strong winds and heavy seas, the pilot vessel cruises about 10 miles southward of the light-vessel. The pilot vessel is equipped with radio and a radio direction finder and is in communication with Calcutta.

The pilot vessel, when sending a pilot to board a vessel, will lie with the wind on her *port* side at all times throughout the year. When supplying a pilot, the pilot vessel will be under way during the South-west monsoon from 15th March to 31st October inclusive; she may be found at anchor during the North-east monsoon.

Masters of vessels wishing to pick up a pilot are advised to approach the pilot vessel from astern of her, heading in the same direction and distant about three ships' lengths. The pilot vessel will go ahead, dropping a pulling or motor boat which should be picked up. The pilot vessel will always either turn round or move sufficiently far ahead to allow the vessel picking up the boat sea room in which to manœuvre. Deep-draught vessels, approaching slowly during the South-west monsoon, should bear in mind that the pilot vessel is drifting to leeward and should approach slightly on her starboard quarter. A long boat rope and a ladder fitted with man ropes should be ready on the starboard side.

Chart 814.

During the South-west monsoon period, from 15th March to 31st October, the pilot vessel when on station at the Sandheads (*Lat. 20° 53' N., Long. 88° 01' E.*), will exhibit *every thirty minutes* between sunset and sunrise, a searchlight beam elevated 30°. The light will be rotated from east to west through south and back again, the total period of exhibition being *one minute*. 5

The pilot vessel shows the ordinary signals of a steam pilot vessel on her station when under way and, in addition, a light at the foremast head, which is exhibited in accordance with orders issued by the local Port Authorities, and also a stern light. By day she displays the usual red and white pilot flag. The pilot flag is only displayed when there are pilots available on board. 10

Should, however, the pilot vessel through any circumstances be at anchor, she will by day display the signal of the International Code of Signals signifying that she is at anchor. At night she will exhibit the lights for a steam pilot vessel at anchor, together with anchor lights. 15

Should an inward-bound vessel arrive at the Sandheads and not find there a vessel showing the above signals, it will be understood that there are no pilots available on the station and instructions should be sought by radio (Sandheads call sign VWS). 20

Tidal streams.—Current.—Seaward of the Sundarbans (page 244), there are strong rotatory streams. During the rising tide the tidal stream commences by setting westward and gradually turns through north to north-east. During the falling tide it commences by setting eastward and gradually turns through south to south-west. 25

At the Sandheads there is a strong westerly current in August ; during September, after the cessation of the South-west monsoon, the westerly current depends on the force and duration of the easterly winds ; in October, there is a westerly and south-westerly current. 30

General instructions.—Vessels arriving at the Sandheads should have their clocks set to Bengal time, *i.e.* 5½ hours in advance of G.M.T. ; this time is kept in the pilot vessel and at Calcutta. Vessels should endeavour to inform the pilot vessel by radio at least 24 hours in advance of their expected time of arrival at the pilot vessel, stating their gross tonnage, draught in fresh water and speed. Vessels wishing to make any sound signals should do so in accordance with Article 28 of the Regulations for Preventing Collisions at Sea. 35

To enable a vessel to get to Calcutta (*Lat. 22° 35' N., Long. 88° 20' E.*) on one tide it is best to arrive at the Sandheads at the time of low water at Sagar island ; it is necessary, however, to have daylight for the last four hours of the passage. 40

Sailing vessels should not run for the station at night or in threatening weather, but under such circumstances put the vessel under easy sail while in deep water, and keep the sea ; they should sound frequently. 45

Sailing vessels arriving at the cruising ground, and finding the pilot vessel at anchor, must use the utmost caution in closing her, on account of the strong tidal streams. When easterly winds prevail there is a strong set westward ; it is then specially incumbent on strangers to be guided by the advice given from the pilot vessel. 50

A sailing vessel arriving at night should heave-to windward of the pilot vessel if intending to take a pilot before daylight, but should close as soon as possible, approaching round the pilot vessel's stern, whether she is at anchor or under way.

Charts 829, 70.

Chart 814.

Signals from the pilot vessel to prepare for bad weather should not be ignored.

The tidal stream should be studied; with the first of the flood 5 setting westward, a vessel should stand eastward, and with the first of the ebb setting eastward, stand westward and northward.

Anchorage.—Caution.—Should it be necessary to anchor, vessels should do so in a position north-westward of Western Channel light-vessel, in a depth of about 12 fathoms (21^m9).

10 When anchoring, vessels should stem the tide before letting go an anchor as the tidal stream runs strongly at the Sandheads. At night, the light-vessel with her single riding light forward is a guide.

Less strain will be brought on a vessel's cable, and riding will be easier, if anchored in depths of from 15 to 20 fathoms (27^m4 to 36^m6), 15 than in lesser depths; the cable is never quite taut in the greater depths, and therefore is not so liable to part, and the sea has less force than when in shoaler water.

Charts 1424, 1425.

Directions.—During the period of the South-west monsoon, it is 20 best to make the Coromandel coast in the vicinity of Bendi creek (page 213), or between it and Ganjām (page 217), where the land is high, as in the latter part of March and in early April, the weather is generally very hazy obscuring the land until very near; it is unadvisable to be northward of Puri (page 218) before ascertaining the 25 vessel's position.

Soundings afford a valuable guide in approaching this coast, depths of 100 fathoms (182^m9) being found about 23 miles south-eastward of Bendi creek and Ganjām, and about 15 miles off Puri (*Lat. 19° 48' N., Long. 85° 51' E.*). At night, vessels should make either Kalingapatam 30 (page 212), Gopālpur (page 216) or Puri lights, sounding constantly whilst closing the land, and bearing in mind that depths of 20 fathoms (36^m6) are found only about 3 miles off Ganjām, and about 12 miles off Puri.

Having fixed the position, vessels should proceed along the coast, 35 keeping in depths of 18 or 20 fathoms (32^m9 or 36^m6) at night or in unsettled weather; with daylight and clear weather, they should sight Jagganāth temple (page 218), and the black pagoda at Konārak (Kanarak) (page 220), in passing.

At night, vessels should keep in depths of not less than 15 fathoms 40 (27^m4) as, the coast being low, it cannot be seen until close-to, and, in hazy weather, the noise of the surf might possibly be the first indication of being near it.

Charts 814, 1425.

When about 10 miles past the black pagoda at Konārak, course 45 should be shaped for a position in *lat. 20° 53' N., long. 88° 01' E.*, paying particular attention to the soundings when passing False point, as the depths decrease gradually towards the bank surrounding it; at night, vessels should keep in depths of not less than 14 or 15 fathoms (25^m6 or 27^m4) or even 20 fathoms (36^m6) if the wind is south-easterly; 50 the tidal stream inclines towards the land with the rising tide and away from it with the falling tide.

Chart 814.

Having made the above-mentioned position, Western Channel light-vessel or the pilot vessel if in sight, may be steered for; low water is

Chart 814.

the most convenient time for deep-draught vessels to arrive here, as the difference between the times of high water at Western Channel light-vessel (*Lat.* 20° 57' N., *Long.* 88° 01' E.) and at Calcutta, enables such vessels to arrive at the latter place in one tide. 5

Towards the close of the South-west monsoon or in September, as the wind often hangs eastward and the current sets strongly south-westward, if the position can be ascertained, vessels should not make the land so far southward.

Chart 829.

During the North-east monsoon, if on the eastern side of the Bay of Bengal, vessels should shape course direct for Western Channel light-vessel. 10

Charts 136, 814.

Quarantine regulations.—A vessel arriving at the Sandheads from an infected port, or having plague on board, or a vessel on board which one or more cases of plague have taken place within 12 days of the date of arrival, shall display the usual quarantine flag and the signal indicating the port left, until permitted, in writing, by the Health Officer to haul them down. 15 20

During this period no communication shall be held with the shore, or with any other boat or vessel, with the exception of the boat supplying the pilot, his leadsman, servant, and baggage.

In the case of a vessel with any case of sickness on board which the pilot has reason to believe to be plague, he shall telegraph to the Health Officer from Sāgar, and not proceed beyond Diamond harbour without permission. If the pilot has no reason to believe that there is any one suffering from plague on board, he shall bring the vessel to Muttiabruj in the river, and anchor her there until visited by the Health Officer. 25 30

Vessels with cases of smallpox, cholera, measles or other epidemic diseases common in India, or of diphtheria or scarlatina, on board, or, if two or more deaths from suspicious causes have occurred during the voyage, are to report the cases to the pilot immediately he boards the vessel, when he will give instructions as to the signals to be displayed. 35

Signals.—Lloyds' agents at Calcutta have facilities for delivering orders at the Sandheads. See also page 34.

Storm and weather signals.—The general system, see pages 30-32 and 239-240, are not exhibited at the Sandheads, but information is available for passing vessels. 40

Chart 748b.

HOOGHLY RIVER.—The Hooghly river is the westernmost, and for commercial purposes, the most important, channel by which the Ganges enters the Bay of Bengal. The navigable channel in the river is subject to annual variations, caused by the difference in direction of the scour of the freshets and flood stream, respectively, during the rainy and dry seasons, whilst the channel through the estuary is subject from time to time to changes across the whole of its width, such as occur in all wide, sandy and tidal estuaries in their natural condition. 45

Chart 829.

On the east, the Hooghly is connected by tidal channels with the various distributaries by which the Ganges enters the sea; some of these form waterways for boat and steamer traffic from Calcutta 50

Charts 829, 70.

Chart 829.

through the Sundarbans to East Pakistan and Assam. The Western Channel light-vessel lies about 126 miles from Calcutta.

Chart 136.

- 5 **Depths.**—The Hooghly river can be navigated as far as Calcutta at high water springs, by vessels of 28 feet (8^m5) draught, and by vessels of 26 feet (7^m9) draught at high water neaps, from June to October, when the river is high ; and by vessels of 26 feet (7^m9) draught from October to June, when the river is low, with normal conditions
10 of bar. See also page 232.

Caution.—Buoyage.—Lighting.—The chart cannot be depended on. The positions of the light-vessels and buoys are shifted as necessary.

- In some parts of the river the changes in depths and in the direc-
15 tions of the channels are very rapid, and therefore no attempt will be made to describe the channels, bars, or depths, which, although correct now, might afterwards be altogether changed in the shortest possible time.

- The buoyage is in accordance with the uniform system of India
20 (see page 34).

- No details are given in this volume of the buoys and light-buoys in the river or of the lights and light-vessels above Gabtola light-vessel (*Lat.* 21° 40' N., *Long.* 88° 00' E.), many of which are often altered to meet changes in the channel, and, as no vessel is permitted
25 to proceed up river without a pilot, a description of these is unnecessary.

- Tidal streams.—Current.**—The relative strengths of the ingoing and outgoing tidal streams vary at different seasons of the year. Their rates are approximately equal during the North-east monsoon, from November to February, when they attain a rate of from 3 to
30 3½ knots at springs, and from 1½ to 2 knots at neaps.

During the period March to June, the South-west monsoon, blowing in the direction of the ingoing stream, increases its rate to from 4 to 6 knots at springs.

- From July to October, freshets cause the outgoing stream to pre-
35 dominate ; it attains a maximum rate of 7 knots at springs, during which time the ingoing stream is hardly appreciable except in the estuary.

Chart 814.

- The tidal streams, when uninfluenced by the wind, set as follows
40 in the Eastern channel :—

Flood		Ebb	
1st Quarter . . .	306°	1st Quarter . . .	126°
2nd Quarter . . .	340°	2nd Quarter . . .	160°
3rd Quarter . . .	025°	3rd Quarter . . .	194°
Last Quarter . . .	070°	Last Quarter . . .	228 and 250°

Both the ingoing and outgoing streams set across Gaspar channel, especially during the last quarter of the falling tide.

Chart 136.

The tidal streams run fairly up and down Sāgar roads.

- 45 **Bore.**—At low water during spring tides, the progress of the incom-

Chart 136.

ing tide is checked by the shallow and restricted bed of the river and by the seaward flow of water from the upper reaches. These conditions are liable to lead to the creation of a bore.

In the Hooghly, bores only occur with greater than average spring tides, and then usually when the seaward flow is augmented by freshets. 5

There is a considerable diurnal inequality in the tides of the Hooghly, the higher high water of spring tides occurring at night between October and March, and in daylight between May and September. A bore is more likely to occur preceding the higher high water than 10 preceding the lower high water.

There is, therefore, a seasonal variation in the probability of the occurrence of a bore.

During the North-east monsoon, from November to February, freshets do not occur and, in consequence, bores are very rare. When 15 they do occur at this season, it is likely to be at night, and because they are unexpected, they are particularly dangerous. It is advisable to anticipate their occurrence during this season whenever greater than average spring tides are predicted.

During the South-west monsoon, the occurrence of freshets during 20 greater than average spring tides, will always cause bores, those preceding the daylight high water being higher than those at night.

The first appearance of the bore is on the Diamond sand, on the west bank of the river below Diamond harbour (page 242) where the ascending wave runs on as a breaking roller, but it is not of much 25 consequence until it enters the contracted reaches above Hooghly point (*Lat. 22° 13' N., Long. 88° 04' E.*) when, besides swamping boats, it affects vessels at anchor, by causing them to run up-stream, especially if there is a strong southerly breeze.

The bore reaches a maximum at Chinsura, about 26 miles above 30 Kidderpore, and disappears above Naya Serai, 14 miles farther up the river. The bore on 30th March, 1896, had a height of nearly 4 feet (1^m2) at Budge Budge and Calcutta, increasing to 5½ feet (1^m6) at Chinsura, and falling to about 18 inches (0^m5) at Naya Serai.

Vessels at moorings surge and roll during the passage of the bore, 35 as there is a sudden lift of from 4 to 6 feet (1^m2 to 1^m8), and when bores are expected, springs must be put on the flood moorings close down to the buoys, to relieve the jerk on the cable and bitts when the bore comes up.

Chart 814.

Western channel. — Light-vessels. — Fog signals. — Buoyage. 40
—Western channel lies between Western Sea reef (page 231) and Eastern Sea reef, the southern extremity of which lies about 16 miles east-south-eastward of the southern end of Western Sea reef; it leads into Beaumont's gut, which leads between Upper Long sand and a shoal 45 extending southward from it on the west, and Lower Long sand, a drying shoal of which Eastern Sea reef is an extension southward, on the east; Beaumont's gut leads to Sāgar roads and Gabtola light-vessel.

Western Channel light-vessel is described on page 232.

Reef light-vessel is situated in Western channel, about 28½ miles 50 southward of Sāgar Island lighthouse and about 3½ miles westward of the southern extremity of Eastern Sea reef; it is painted red with the name in white letters on the sides, and has one mast with a black cone as topmark. A light is exhibited at an elevation of 35 feet (10^m7)

Chart 814.

from a structure situated amidships. In addition to its characteristic light, the vessel exhibits a *white flashing* riding light showing *one flash every second*. A fog signal is sounded from the light-vessel. Reef station buoy, painted red and surmounted by a red framework basket, is moored about 2 miles west-north-westward of the light-vessel.

A can buoy, painted black, marked "E.B." and surmounted by a staff and black drum, is moored about 30 miles south-westward of Sāgar Island lighthouse and about $1\frac{1}{4}$ miles westward of the southern extremity of Western Sea reef.

Beaumont's Gut light-vessel, which is unwatched, is moored about $19\frac{1}{2}$ miles south-south-westward of Sāgar Island lighthouse and about $2\frac{1}{2}$ miles westward of the western edge of Eastern Sea reef; it is painted red with the name in white letters on the sides, and has one mast with a black ball as topmark. A light is exhibited, at an elevation of 35 feet (10^m7) from a light-structure situated amidships. In addition to its characteristic light, the vessel exhibits a *white flashing* riding light showing *one flash every second*. A fog signal is sounded from the light-vessel.

The western side of the bar leading from Western channel into Beaumont's gut is marked by two black conical buoys marked L.W.B. Gut and U.W.B. Gut. L.W.B. Gut buoy marks the southern side of the bar and is moored about 5 miles northward of Beaumont's Gut light-vessel; U.W.B. Gut buoy is moored about $2\frac{1}{2}$ miles farther northward.

Chart 136.

Lower Long Sand light-vessel, which is unwatched, is moored on the eastern side of Beaumont's gut, about $7\frac{1}{2}$ miles south-south-westward of Sāgar Island lighthouse; it is painted red with the name in white letters on the sides. A light is exhibited, at an elevation of 27 feet (8^m2), from a light-structure situated amidships. In addition to its characteristic light, the vessel exhibits a *white flashing* riding light showing *one flash every second*.

The north-western end of Beaumont's gut is marked by a black can light-buoy, marked U.L.S. and exhibiting a *red group flashing* light showing *two flashes every ten seconds*, moored close eastward of Upper Long sand and about $4\frac{1}{4}$ miles south-westward of Sāgar Island lighthouse (*Lat. $21^{\circ} 39' N.$, Long. $88^{\circ} 03' E.$*).

The eastern side of Sāgar roads is marked by a red conical light-buoy, marked L.S.F. and exhibiting a *white flashing* light *every seven seconds*, moored about 2 miles west-south-westward of Sāgar Island lighthouse.

Gabtola light-vessel is moored on the north-western side of Sāgar roads, about 3 miles west-north-westward of Sāgar Island lighthouse; it is painted red with the name in white letters on the sides. A light is exhibited, at an elevation of 31 feet (9^m4), from a light-structure situated amidships. In addition to its characteristic light, the vessel exhibits a *white flashing* riding light, showing *one flash every second*.

The channels northward of Gabtola light-vessel are marked in accordance with the uniform system of buoyage, *see page 34*.

In 1951, Eden channel, leading northward of Upper Long sand into Sāgar roads, was not in use.

Chart 814.

Eastern channel.—Buoys.—Eastern channel, another entrance to Hooghly river, lies between Eastern Sea reef on the west, and a shoal

Chart 814.

which, with depths of less than 3 fathoms (5^m5), extends about 25 miles south-south-eastward from New island, on the east; the southern extremity of New island lies about 12 miles south-eastward of Sāgar Island lighthouse.

Eastern Channel station buoy is described on page 232.

A can buoy, painted black, marked "T.R." and surmounted by a staff and black drum, is moored on the western side of Eastern channel, about 34 miles southward of Sāgar Island lighthouse.

A bell buoy, painted in red and white horizontal stripes and surmounted by a red ball, is moored on the western side of Eastern channel, about 22 miles south-south-eastward of Sāgar Island lighthouse.

Eastern channel and Gaspar channel, its continuation northward, are marked in accordance with the uniform system of buoyage, *see* page 34. In 1950, the northern end of Gaspar channel, leading into Sāgar roads, was blocked by shoals.

Chart 136.

Sāgar island.—Light.—Sāgar island, locally known as Saugor island, is separated from the mainland eastward by Channel creek or Bārātala river. It is composed of low, alluvial soil and, except for a narrow fringe of jungle at its southern end, is almost entirely cleared for cultivation. It is intersected by numerous creeks or khāls, which are steadily silting up since the island has been cleared. There are numerous small villages on the island.

A light is exhibited, at an elevation of 84 feet (25^m6), from a circular tower with red and white bands, 80 feet (24^m4) in height, situated on the south-western side of Sāgar island.

Sāgar roads.—Anchorage.—Sāgar roads, locally known as Saugor roads, are situated on the south-western side of Sāgar island and afford safe anchorage in ordinary weather, in depths of from 5 to 8 fathoms (9^m1 to 14^m6); during heavy gales, a considerable swell rolls into the roads at high water.

Signal stations.—Signal stations are situated near the lighthouse on Sāgar island; at Diamond harbour (*Lat.* 22° 11' N., *Long.* 88° 11' E.), on the left bank of the river about 38 miles above Sāgar roads; and at Hooghly point, about 6 miles above Diamond harbour and on the same bank. Diamond Harbour signal station is connected by telegraph, and the other signal stations by telephone, with Calcutta.

Climatic table.—*See* page 76.

Storm and weather signals.—When the weather in the Bay of Bengal is disturbed, storm signals are shown at the following positions:—

Sāgar Island lighthouse; near the telegraph office, Diamond harbour; near the clock tower at the entrance to Kidderpore docks; and on the Port Commissioner's office.

These signals are the same as those that are described on pages 30-32, but a more detailed signification of certain of the signals is as follows:—

Signal V indicates that a storm of slight or moderate severity will probably cross the coast eastward of Sāgar island and westward of Chittagong. Vessels may proceed to sea if the height of the barometer, state of the sea, and weather, are such as to lead masters and pilots to infer that there is no danger. The wind at the mouth of the Hooghly

Chart 136.

will probably back from north-east, through north, to north-west or west.

Signal VI indicates that a storm of slight or moderate severity will probably cross the coast westward of Sāgar island and northward of False point. The wind at the mouth of the Hooghly will probably veer from north-east, through east, to south-east or south. As these easterly winds will raise a heavy swell and produce a strong westerly set in the channel at the Sandheads, it is advisable that none but fast power vessels in light trim should put to sea, and those only if the weather appearances and state of the sea are not too unfavourable.

Signal VII indicates the approach towards Sāgar roads (*Lat. 21° 38' N., Long. 88° 00' E.*) of a storm of slight or moderate intensity. It is advisable that no vessels, except fast vessels in light trim, should put to sea until the wind direction and force, the state of weather and sea, and the rise of the barometer, indicate that the storm has either broken up or passed inland. It should be remembered that cyclonic storms of small extent in the Bay of Bengal sometimes blow with hurricane force, and raise a high sea near their centres.

Signal VIII indicates that a storm of great intensity will cross the coast eastward of Sāgar island and westward of Chittagong. No sailing vessels, nor deep-laden, or vessels of low power, should put to sea, but should remain in the river until the storm has reached the coast and passed inland. The wind at the mouth of the Hooghly will probably back from north-east, through north, to north-west, or west.

Signal IX indicates that a storm of great intensity will cross the coast westward of Sāgar island and northward of False point. No vessel should go to sea, and masters and pilots of vessels outward-bound should be guided by the appearance of the weather and height of the barometer in deciding whether it is advisable to proceed below Diamond harbour or Mud point. The wind at the mouth of the Hooghly will probably veer from north-east, through east, to south-east or south.

Signal X indicates the approach of a storm of great intensity towards the mouth of the Hooghly and Calcutta. No vessels should put to sea from Sāgar island, or proceed down river from Diamond harbour, and all vessels should be properly secured.

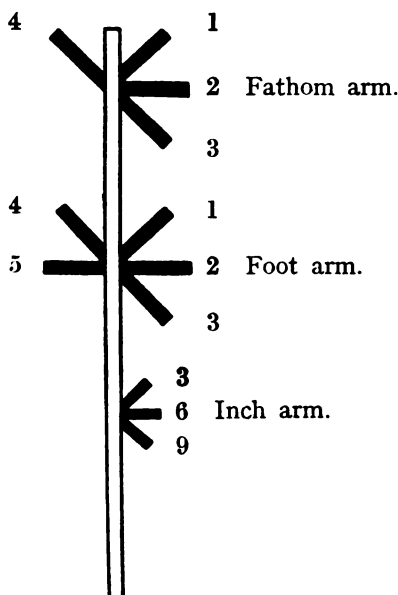
The masters of vessels in the port should take the special precautions for safety laid down in the port rules.

Note.—A severe cyclonic storm is frequently accompanied by a storm wave, which is not often the case with a small cyclonic storm. The height and destructive effect of a storm wave depend quite as much on the state and character of the tide when the cyclonic centre reaches the coast, as upon the depression of the centre, or the intensity and extent of the storm.

Tidal signals.—Tidal semaphores have been established at the following places to indicate the rise of the tide in the Hooghly river :— About a mile south-westward of the lighthouse on Sāgar island ; at Gangra on the west bank, about $7\frac{1}{2}$ miles north-westward of the northern point of Sāgar island ; at Balari, on the west bank of the river, about 11 miles north-north-eastward of the tidal semaphore at Gangra ; on Hooghly point, about 12 miles above Balari ; at Moyapur, about $16\frac{1}{2}$ miles below Kidderpore docks ; at Akra, about $6\frac{1}{2}$ miles below Kidderpore docks ; and at Rajabagan.

Chart 136.

The semaphores have three arms, the upper of which indicates fathoms, the middle feet, and the lower inches, as shown in the diagram below :—



Night semaphores are established at Sāgar (Lat. $21^{\circ} 39' N.$, Long. $88^{\circ} 03' E.$), Gangra and Balari.

Each semaphore can exhibit two *flashing* lights, an upper light showing a *two-second* flash *every eight seconds* and a lower light showing a flash *every second*.

The rise of the tide is indicated as follows :—

5 feet (1^m5) and 15 feet (4^m6)—upper light *green*. 10

6 feet (1^m8) and $15\frac{1}{2}$ feet (4^m7)—both lights *green*.

7 feet (2^m1) and 16 feet (4^m9)—*green* over *red*.

8 feet (2^m4) and $16\frac{1}{2}$ feet (5^m0)—*green* over *white*.

9 feet (2^m7) and 17 feet (5^m2)—lower light *green*. 15

10 feet (3^m0)—upper light *red*.

$10\frac{1}{2}$ feet (3^m2)—*red* over *green*.

11 feet (3^m4)—both lights *red*.

$11\frac{1}{2}$ feet (3^m5)—*red* over *white*.

12 feet (3^m7)—lower light *red*. 20

$12\frac{1}{2}$ feet (3^m8)—upper light *white*.

13 feet (4^m0)—*white* over *green*.

$13\frac{1}{2}$ feet (4^m1)—*white* over *red*.

14 feet (4^m3)—both lights *white*.

$14\frac{1}{2}$ feet (4^m4)—lower light *white*. 25

Kalpi roads.—**Compass adjustment marks.**—Kalpi roads is situated about 31 miles above Sāgar roads.

A mast, painted black and surmounted by a black basket, stands on the right bank of the river on the western side of Kalpi roads ; it is intended as a mark to enable vessels to ascertain the error of the 30

Charts 814, 829, 70.

Chart 136.

compass, and when in line with Jhikurkhāli (Jigerkhali) obelisk, about 4 cables westward of it, bears 281° .

Diamond harbour.—Anchorage.—Diamond harbour, situated about 5 miles above Kalpi roads, affords anchorage for large vessels in depths of from 6 to 13 fathoms (11^m0 to 23^m8). There is a signal and telegraph station and a Custom house on the left bank of the river which forms the northern shore of Diamond harbour. This is the second reporting station for passing vessels.

10 CALCUTTA.—The port of Calcutta extends from Budge Budge, about 21 miles above Hooghly point, to Konnager, a distance of about 23 miles farther up river, the limits being marked by boundary pillars. The port is about 80 miles above the entrance to the river, and about 126 miles from Western Channel light-vessel, near the Sandheads. The
15 port is administered by a Port Commission which has jurisdiction over the port, and also in the navigable channels leading to the port from a line drawn east and west through Western Channel light-vessel.

Extracts from the Port Regulations are supplied to vessels on arrival.

Howrah bridge, about 15 miles above the down-river boundary of
20 the port, crosses the river above Howrah railway terminus and is a steel cantilever structure, with towers on either side of the river which rise to an elevation of 300 feet (91^m4) above water level. There are several ferries which ply across the river.

Lights.—Twin red obstruction lights are exhibited from each of the
25 two towers of Howrah bridge on either side of the river, and similar lights are exhibited from the centre of the bridge.

Berthage.—Moorings are laid down for a large number of vessels, and there are sufficient depths at the moorings to accommodate any vessel that can enter the river. Large numbers of vessels can also
30 be accommodated at the jetties, or in the basins. The depths at the mooring berths vary according to their locality, but provision is made for vessels up to 31 feet (9^m4) draught, both at the Garden reach and the Budge Budge jetties and in King George V docks; in the Kidderpore docks (*Lat.* $22^{\circ} 32' N.$, *Long.* $88^{\circ} 19' E.$), vessels may
35 load to a maximum draught of 29 feet (8^m8).

Vessels mooring in the river are required to moor head and stern, with two bower and two stern cables shackled to the permanent moorings which are laid parallel with the banks.

The docks and jetties are equipped with cranes, and are connected
40 to the railway system.

Navigation.—Vessels proceeding against the tidal streams should ease down or stop if likely to meet other vessels at difficult parts of the river, or on bars where the deep channels are narrow. The usual rule of the road is adhered to in the river and estuary. A prolonged
45 blast of the steam whistle, quickly followed by three short blasts, is an optional signal that the vessel making the signal is obliged to stop, and cannot get out of the way.

Tidal streams.—Currents.—During the North-east monsoon the ingoing stream runs for 5 hours, reaching maximum rates of from
50 3 to $3\frac{1}{2}$ knots at springs and of from $1\frac{1}{2}$ to 2 knots at neaps. During March and July, the direction and rate of the ingoing stream are increased, and it runs until one hour after high water, reaching a maximum rate of from 4 to 7 knots at springs. During freshets, from

Chart 136.

July to October, the ingoing stream is weak and of short duration and at neaps may be hardly appreciable in the river.

During the North-east monsoon the outgoing stream runs for 7 hours; at springs it ends soon after low water, but at neaps it may run until a little more than one hour after low water. It reaches a maximum rate of from 3 to $3\frac{1}{2}$ knots at springs and of from $1\frac{1}{2}$ to 2 knots at neaps. During freshets, the duration and rate of the outgoing stream are increased, and it runs until rather more than one hour after low water and has a maximum rate of 7 knots at springs.

Both streams set fair up and down Calcutta reach.

During the freshets, anchors are quickly buried in the silt, and it is sometimes necessary to slip the cable, leaving the anchor to be recovered by the Port Commissioners.

City.—The city of Calcutta is situated on the left bank of the Hooghly river and extends along the river bank for about 6 miles. On the opposite bank and linked to the city by the Howrah road bridge, is the important suburb of Howrah. In 1951, the population of Calcutta with Howrah was 2,992,997.

In the centre of the city stands Fort William, surrounded by an expanse of park known as the Maidan; northward of this is the business quarter and eastward and southward is the residential quarter.

Port facilities.—Large stocks of coal, fuel oil and diesel oil are maintained. Coal can be embarked at moorings in the river from lighters, or alongside the wharves by baskets, or by mechanical plant, at rates of from 1,000 to 4,000 tons in 24 hours.

Oil can be embarked at moorings from tank lighters or alongside wharves from pipelines at rates of from 40 to 80 tons per hour.

Water is laid on to the wharves and can be supplied to vessels in the stream by water boat.

All repairs to vessels can be effected and there are several dry docks and patent slips. For details of the largest dry dock, *see* Appendix I, page 488.

All the wharves are equipped with cranes, the largest of which has a lifting capacity of 30 tons, and there is a sheer-legs with a lifting capacity of 100 tons at Kidderpore docks (*Lat.* $22^{\circ} 32' N.$, *Long.* $88^{\circ} 19' E.$), about 3 miles below Howrah bridge. There are four floating cranes, two of which have a lifting capacity of 60 tons; one of the latter is self-propelled. There are numerous tugs available.

There are several large hospitals to which seamen can be admitted and there is a Mariners club near King George V docks.

There is regular sea communication with all parts of the world.

There is regular air communication with Europe, the Far East, South-east Asia and Australia from Dum Dum airport, about 7 miles east-north-eastward of the city.

The principal exports are:—Coal, gunnies, jute, tea and ores; and the chief imports are:—Food grains, petroleum, salt and cement.

In 1949, 1,214 vessels of a total tonnage of 7,385,320, entered the port.

Radio station.—**Radio D.F. station.**—There is a radio station at Calcutta, *see* page 38.

A radio direction finding station is situated about 7 miles southward of Howrah bridge.

Deratisation.—Deratisation can be carried out and deratisation

Chart 136.

certificates issued to vessels in accordance with the International Sanitary Convention, *see* page 40.

Climatic table.—*See* page 77.

5 *Chart 829.*

THE SUNDARBANS.—The Sundarbans, which are described on page 12, extend eastward for about 165 miles from the Hooghly river. The western and eastern portions are high when compared with the low and swampy central part, towards which the ground gradually slopes.

- 10 In the western part, the water in the streams is usually salt, and the cultivated lands are surrounded by high embankments with scattered groups of huts. In the central part there are no habitations, the water is fresh, and the embankments surrounding the fields are lower. In the eastern part, the land is high, the soil is richer, and, 15 as the river water in this part is almost fresh, embankments are not necessary; the inlying parts are to a great extent protected from the effects of cyclonic storm waves by the belt of thick jungle near the sea.

- The chief place in the Sundarbans is Khulna, about 65 miles eastward of Calcutta, at the junction of the Athārabānki and Bhairab 20 rivers, towards which boats can be tracked through the Calcutta canals. Khulna is connected to the general railway system.

- The only port of any importance in the Sundarbans is Chalna anchorage, a new port on the Pussur river about 60 miles above its mouth and about 15 miles below Khulna. It was opened in December, 25 1950 and is designed to take a considerable burden off the port of Chittagong and also to serve as a distributing centre for the Brahmaputra area of East Pakistan. In 1951, this port was stated to be available to vessels of a draught of 23 feet (7^m0).

- Storm signals.**—Special signals are used on the rivers of the 30 Ganges delta, and are shown at Namkhana, Barisāl, Goalunda, Noāk-hāli, Nārāyanganj, Chandpur, Khulna, and at some river police stations in East and West Bengal and Assam.

Signal I.—Warning.—By day: A black ball indicates a storm may affect you shortly.

- 35 By night: A *red* light is hoisted.

Signal II.—Danger.—By day: A cone, point up, indicates a storm will soon strike you.

By night: Two *red* lights, disposed vertically.

- Signal III.—Great danger.—By day: A cylinder, displayed verti- 40 cally, indicates a violent storm will soon strike you.

By night: Three *red* lights, disposed vertically.

Charts 136, 814.

- Coast.**—Eastward of Sāgar island are a series of low, alluvial, jungle-grown islands, intersected by numerous creeks and rivers, 45 and with sands extending many miles southward of them. No reliable information can be given about this stretch of coast, and the chart must be used with caution. Very rapid changes have been going on of late years in the south-western part of the Sundarbans.

- Lacams channel leads into Bārātala river between the shoal extending southward from New island and Saptamukhi sand (*Lat.* 21° 18' N., 50 *Long.* 88° 26' E.), but cannot now be used by seagoing vessels.

Chart 814.

Saptamukhi channel, which lies between Saptamukhi and Bulcherry

Charts 829, 70.

Chart 814.

sands, forms the common entrance to Saptamukhi river on the west, and Jāmira river, on the east. Neither of these rivers is visited by sea-going vessels.

Chart 82.

5

Mātla river.—**Caution.**—Mātla river flows into the sea eastward of Bulcherry sand. The entrance is divided into Western and Eastern channels by Raimatla sand, which dries in places about 8 miles southward of Dalhousie point, the south-western point of Dalhousie island. The river is connected with the salt-water lake, near Calcutta, by 10 Bidyadhari river.

The shoals at the entrance of the river are liable to change, and the following information must be used with caution. There are no pilots for Mātla river.

Channels.—**Navigation.**—Western or Ward's channel, which lies 15 between Bulcherry and Raimatla sands, has a least charted depth of 4 fathoms (7^m3) westward of the northern prong of Raimatla sand, and is to be preferred to Eastern channel.

Eastern or Raimatla channel, which lies between Raimatla and Dalhousie sands, has a least charted depth of 5½ fathoms (10^m1), 20 but there are some 5-fathom (9^m1) patches in the channel in places.

The chief difficulty in the navigation of the river is the fact that the depths are so regular between Dalhousie point and a position about 36 miles southward, that sounding gives no indication as to the position of a vessel as regards the edges of the sands on either side, and these, 25 both in the channels and in the river, are so steep-to that borrowing on them is dangerous.

On Dalhousie point there are clumps of trees, the westernmost appearing double and larger than the rest; this point and Halliday island westward of Dalhousie island, may be seen from a distance of 30 about 10 miles when at a height of about 24 feet (7^m3). When near to, Dalhousie point appears as a high white sandy beach, and is conspicuous when the sun is shining.

Below Catalle (Kattali), situated 12 miles northward of the northern point of Dalhousie island, the land is so low that at high water springs 35 the water runs some distance inland; from the sea to Eedoo reach, about 23 miles above Catalle, there is dense jungle, but from that reach to Port Canning (*Lat.* 22° 19' N., *Long.* 88° 40' E.), a distance of about 8 miles, there are clearances with native villages.

Tidal streams.—The tidal streams below Dalhousie sand appear 40 to rotate, the stream on the rising tide setting west-north-westward at its commencement and working through north, to east-north-east; and the outgoing stream setting east-south-east, through south, to west-south-west, at rates of from 2 to 3 knots at springs, and from one knot to 1½ knots at neaps. 45

In the channel the ingoing stream tends towards the eastern shore until abreast Dalhousie river, at the northern end of Dalhousie island, when it crosses southward of Grappler sand towards Peel point, forming eddies; it then runs northward to Roger point, a distance of about 8 miles, where it bifurcates, the greater portion going up Bidya 50 (Bidda) river, and the rest round Roger point into Catalle bight, leaving slack water in the vicinity of Bidya River point.

The rate of the flood stream varies in different parts of the river, but 5 knots is the maximum recorded.

Chart 82.

The outgoing stream sets fairly down the river, but it forms considerable eddies off Roger point ; the last of the outgoing stream sets from abreast the northern end of Dalhousie island across the river 5 towards Galliday island. The greatest recorded rate of the outgoing stream is $2\frac{1}{2}$ knots.

Port Canning.—Port Canning, about 60 miles from the mouth of the Mātla river, was reported, in 1908, to be almost deserted. It is connected to the general railway system.

- 10 Vessels with local knowledge may obtain anchorage off Port Canning, in depths of from 4 to 8 fathoms (7^m3 to 14^m6).

Chart 814.

- Dalhousie point to Pussur river entrance.**—**Coast.**—The entrance to Bāngaduni river lies between Dalhousie island and sand, on the west, and Bāngaduni island and sand, on the east. There is a least 15 charted depth of 3 feet (0^m9) over the bar, which connects the northern part of Dalhousie sand to the south-western point of Bāngaduni island.

Charts 814, 859.

- 20 The entrance to Guāsuba river lies eastward of Bāngaduni island and is encumbered with shoals.

Chart 859.

- Hāriābhāngā river, the mouth of which lies about 12 miles east-north-eastward of Guāsuba river, and Raimangal river, about 4 miles 25 farther eastward, enter the sea through a common estuary which extends about 6 miles southward ; the mouth of this estuary is one of the widest openings on this coast and has a least charted depth of $3\frac{1}{2}$ fathoms (6^m4) in its approaches, but local knowledge is necessary for its navigation.

- 30 Putney (Putni) island, about 8 miles eastward of the wide estuary, lies in the mouth of Malancha river, dividing the entrance into two channels. Flats, with depths of less than 3 fathoms (5^m5) over them, extend about 11 miles southward and south-eastward from Putney island. There is a least charted depth of 3 fathoms (5^m5) in the 35 approaches to the entrance channel westward of Putney island, with greater depths within the entrance. Barapanga river joins Malancha river from eastward about 4 miles above Putney island. About 9 miles eastward of Putney island is the entrance to Pussur river.

Charts 814, 859.

- 40 **Swatch of No Ground.**—Swatch of No Ground is a remarkable depression in the coastal bank which extends in a south-westerly direction from a position in about lat. $21^\circ 24' N.$, long. $89^\circ 34' E.$, where it descends steeply from depths of 20 fathoms (36^m6) to more than 100 fathoms (182^m9). It is from 6 to 12 miles in width, with 45 depths of over 100 fathoms (182^m9) for a distance of about 46 miles, at which distance there is a depth of 595 fathoms (1088^m2).

Chart 859.

- Pussur river.**—**Zulfiquar channel.**—**Dangers.**—Pussur river is entered between West point (Lat. $21^\circ 42' N.$, Long. $89^\circ 25' E.$), about 50 $4\frac{1}{2}$ miles eastward of Putney island, and Jefford point, about 7 miles farther eastward ; there is a bar in the approach to the river between 4 and 8 miles southward of the entrance, but vessels of a draught of 23 feet (7^m0) can cross the bar at neap tides and ascend the river as far as Chalna anchorage, about 60 miles above the entrance.

Charts 829, 70.

Chart 859.

Zulfiquar channel leads from the northern side of the bar to a deep water channel between shoal banks off West and Jefford points, and thence northward through an estuary formed by the junction of Sipsa and Pussur rivers which unite at Sipsa (Sipsah) point, situated about 15 miles northward of Jefford point.

Sarwar sand, a shoal awash at high water, lies on the western side of Zulfiquar channel about $4\frac{1}{2}$ miles southward of Hiran point, which is situated about 5 miles north-eastward of West point; a spit with depths of as little as a quarter of a fathom (0^m5), over which the sea breaks, extends about $2\frac{3}{4}$ miles southward from Sarwar sand.

From Boar point, situated on the eastern side of Zulfiquar channel about 5 miles northward of Jefford point, a narrow spit on which the depths are less than 2 fathoms (3^m7) and on which the sea breaks in heavy weather, extends southward for about 7 miles, passing about $1\frac{1}{2}$ miles westward of Jefford point and forming the eastern side of Zulfiquar channel; extensive tide rips and eddies mark the edge of this spit and also the edge of Sarwar sand.

Pavanga shoal, with a least depth of $1\frac{1}{2}$ fathoms (2^m7) over it, lies nearly in the middle of Zulfiquar channel, about 2 miles north-westward of Boar point (*Lat.* $21^\circ 50' N.$, *Long.* $89^\circ 31' E.$).

Pussur light-vessel.—Radiobeacon.—The approach to the entrance to Pussur river is marked by a light-vessel, painted red, with the name PUSSUR in white letters on its sides, moored in deep water about 23 miles south-eastward of West point and about $6\frac{1}{2}$ miles north-eastward of the northern end of Swatch of No Ground. A light is exhibited, at an elevation of 32 feet (9^m8), and a radiobeacon transmits, from the light-vessel.

Entrance channel.—Buoyage.—The bar is about 4 miles wide at its narrowest part and had, in 1953, a least depth of 17 feet (5^m2) in a buoyed channel across it. A large light-buoy, painted black and exhibiting a *white group flashing* light, showing *three* flashes every ten seconds, is moored about 4 miles eastward of the southern extremity of the bar and about $7\frac{1}{2}$ miles north-westward of Pussur light-vessel.

The western sides of the channel across the bar, and the southern part of Zulfiquar channel, are buoyed as follows:—

Outer bar No. 1, a red conical buoy is moored about $9\frac{1}{2}$ miles west-north-westward of Pussur light-vessel.

Outer bar No. 2, a light-buoy painted red with black superstructure, and exhibiting a *white flashing* light *every seven seconds*, is moored about $12\frac{1}{2}$ miles north-westward of Pussur light-vessel.

Middle bar No. 3, a light-buoy painted red and exhibiting a *white flashing* light *every five seconds*, is moored about $7\frac{1}{2}$ miles south-eastward of West point.

South Sarwar sand No. 4, a light-buoy painted red with black superstructure, and exhibiting a *white group flashing* light showing *two* flashes *every ten seconds*, is moored about $4\frac{1}{2}$ miles east-south-eastward of West point.

North Sarwar sand No. 5, a light-buoy painted red and exhibiting a *white group flashing* light showing *two* flashes *every four seconds*, is moored about $3\frac{1}{2}$ miles east-north-eastward of West point.

Vessels entering Pussur river should leave the channel buoys on the port hand, and out-going vessels on the starboard hand.

A can buoy, painted red and surmounted by a truncated cone, is

Chart 859.

moored about $3\frac{1}{2}$ miles southward of Boar point and marks the western edge of the spit extending southward from that point.

Light.—Beacons.—Tide gauges.—A light is exhibited, at an elevation of 64 feet (19^m5), from a white wooden structure, 10 feet (3^m0) in height, situated on Boar point.

A small beacon stands close within the eastern edge of Sarwar sand, about one mile south-westward of North Sarwar sand buoy, and there are also beacons on Jefford and Sipsa points, at elevations of about 10 36 and 60 feet (11^m0 and 18^m3), respectively.

Tide gauges have been erected on Hiran point; at Sunderkota, about 9 miles above Sipsa point; at Chandpai, about 13 miles farther up river; and at Chalna anchorage.

River above Sipsa point.—Buoys.—Pussur river between Sipsa point and Chalna anchorage is moderately broad and easily navigable. The whole of this length of the river is marked with cylindrical buoys; black buoys are to be passed on the port hand, and red buoys on the starboard hand, by ingoing vessels, and *vice versa* by outgoing vessels.

Pilotage.—Pilotage is compulsory for all vessels entering Zulfiquar channel and no vessel should attempt to navigate the Pussur river without a pilot. Vessels requiring a pilot should give 24 hours' notice to the Chalna Port Authorities at Khulna (*Lat. $22^{\circ} 47' N.$, Long. $89^{\circ} 31' E.$*).

The pilotage ground and cruising station of the pilot vessel is about 25 7 miles north-westward of Pussur light-vessel. The pilot vessel as well as Pussur light-vessel will maintain radio contact with approaching vessels and will give any necessary instructions to vessels' masters.

When weather permits, the pilot will board vessels at the pilotage ground; if necessary, vessels may anchor for this purpose in depths 30 of about 9 fathoms (16^m5).

During the South-west monsoon, a southerly wind of force 4 or more often renders boat work impossible and, in these circumstances, the pilot vessel will lead vessels across the bar to a more sheltered position above Boar point, where the pilot will board. During this manoeuvre, 35 vessels should keep strictly in the wake of the pilot vessel. While the pilot is being transferred, vessels should steer north with engines dead slow and should lower a pilot ladder, with at least 3-inch man ropes, on the lee side.

Anchorage.—Anchorage may be obtained generally as convenient 40 in Zulfiquar channel; a good berth sheltered from the South-west monsoon, is in depths of from 4 to 5 fathoms (7^m3 to 9^m1), about $1\frac{1}{2}$ miles north-eastward of Hiran point. Anchorage with good holding ground but less sheltered, may be obtained in depths of about $4\frac{1}{2}$ fathoms (7^m8), about $1\frac{1}{2}$ miles north-eastward of Sarwar sand. 45 During the North-east monsoon, anchorage may be obtained outside the bar, in depths of about 4 fathoms (7^m3) good holding ground, about 2 miles south-eastward of No. 2 channel light-buoy. Vessels with local knowledge may obtain anchorage in the wider reaches of Pussur river above the estuary.

50 **Tidal streams.**—At the Outer Bar buoy the outgoing stream sets about south-south-east and the ingoing stream about north-north-west, with rates at springs of about 2 knots in the North-east monsoon. During the South-west monsoon the outgoing stream is rather stronger and the ingoing stream correspondingly weaker.

Charts 829, 70.

Chart 859.

In Zulfiqar channel the outgoing stream has a rate of about 3 knots at springs and the streams turn at about one hour after high and low water in the entrance to Pussur river.

At Chalna anchorage the outgoing stream has a rate at springs of about 4 knots, and the streams turn at about $4\frac{1}{4}$ hours after high and low water in the entrance to Pussur river.

Directions.—Caution.—The coast in the vicinity of the estuary is low and the visibility in the approaches, except at the change of seasons, is generally hazy. During the South-west monsoon, thick weather is general, and at all times the coast must be approached with caution and with constant sounding. In clear weather, Jefford point beacon may be seen from the pilotage ground, but land is not normally sighted until vessels are crossing the bar, when the coast may be sighted in the vicinity of Jefford point, which is sandy and grass-covered, while the adjacent coast is covered with jungle. Fog in the river and off the coast occasionally occurs at the change of seasons, but the weather then generally clears by 10 o'clock in the forenoon.

A normal indication of approach to shallow water is the change from blue or blue-green to a muddy yellow colour, but it must be borne in mind that, during the ebb stream at springs, yellow water is found as far seaward as Swatch of No Ground.

After making Pussur light-vessel, vessels should shape course for the pilotage ground and thence should proceed across the bar in a 340° direction, and eastward of Sarwar sand in a 359° direction, passing Nos. 1, 2, 3, 4 and 5 channel buoys within half a mile on the port hand. When abreast North Sarwar sand buoy course may be shaped to pass about 3 cables westward of Boar point (*Lat. $21^\circ 50' N.$, Long. $89^\circ 31' E.$*).

Chalna anchorage.—Port facilities.—Chalna anchorage is over one mile in length with a least depth of 24 feet (7^m3). Vessels may either anchor or secure to moorings, of which three swinging berths are available at the anchorage; cargo is transported direct from vessels to inland river barges using the vessel's own appliances.

The nearest hospital is at Khulna, about 20 miles northward of Chalna.

Limited supplies of coal are available. There is no supply of fresh water at Chalna, but a limited amount might be supplied from Khulna by barge in an emergency.

The Port Health Officer is stationed at Khulna.

Communications.—Chalna has no road or railway connections. There is a daily river service between Chalna and Khulna and the latter town is connected with the general railway system. There is daily air service with all parts of the world from Jessore, situated about 35 miles by rail from Khulna.

Caution.—During the months of March, April and May, severe north-westerly gales may be experienced at Chalna anchorage. They usually commence in the early afternoon and last for a few hours only.

Jefford point to Haringhāta river.—Argo flat.—The entrance to Bhāngrā (Bangara) river lies about 9 miles east-north-eastward of Jefford point; a branch of this river flows into the northern end of Zulfiqar channel close southward of the junction of Sipsa and Pussur rivers.

Haringhāta or Baleshwar river, the entrance to which lies between Tiger point, situated about 10 miles east-north-eastward of the mouth

Chart 859.

of Bhāngṛā river, and the coast about 7 miles eastward, is the outlet of one of the principal tributaries of the Ganges, the river and its branches passing through a tract of fertile country.

- 5 The river, which has a bar, over which there are charted depths of about $2\frac{1}{2}$ fathoms (4^m6), is navigable by sea-going ships with local knowledge as far as Morrellganj, about 23 miles from the entrance, and throughout its entire course by the largest native boats. The navigation is reported not difficult for vessels with local knowledge, as the
10 river is free from a bore, and also from mid-channel dangers.

A heavy sea prevails at the entrance during the South-west monsoon, and it should not be entered without local knowledge.

The rate of the tidal streams is reported to exceed 4 knots at springs.

- At Morrellganj, the river, which is tidal, is about a quarter of a mile
15 wide, with deep water affording sheltered anchorage with good holding ground; it is an important place of call for the local vessels.

- Barisāl (*Lat. $22^{\circ} 42' N.$, Long. $90^{\circ} 21' E.$*), the headquarters of the Bakarganj (Backergunge) district, is situated on the Barisāl river, which is connected with Morrellganj; river steamers ply between these
20 two places. Steamers ply from Barisāl to Khulna and Nārāyanganj, establishing communication with Calcutta and Dacca, respectively. There is also sea communication with Patuakhali, about 20 miles southward of Barisāl.

- Argo flat is an extensive shallow bank which, with depths of less than
25 3 fathoms (5^m5), fronts the coast between Pussur point, situated about 3 miles east-south-eastward of Jefford point, and Landfall point, on the eastern side of the entrance to Haringhāta river about 30 miles east-north-eastward of Pussur point. The flat extends as much as 18 miles offshore, and dries in patches between 2 and 10 miles southward
30 of Tiger point; heavy breakers have been observed at this latter position.

- Rabnabad channel.**—Rabnabad channel, lying between Rabnabad islands and the mainland westward, is entered about 8 miles east-north-eastward of Landfall point; the channel is narrow and has a least
35 charted depth of $2\frac{1}{4}$ fathoms (4^m1) in its northern part. After rounding the northern point of the westernmost Rabnabad island, the channel connects with Ganges river through Kājal and Tetulia rivers, which are little known.

Dangers between Rabnabad channel and Sandwip island.—

- 40 **Caution.**—Between the mouth of Rabnabad channel and Sandwip island, about 70 miles east-north-eastward, there is a large area which has not been surveyed. Shallow flats extend several miles seaward between the mouth of Rabnabad channel and the entrance to Shāhbāzpur river, about 45 miles east-north-eastward.

- 45 D'Apres shoal, a sandbank which dries, lies on the eastern side of the entrance to Shāhbāzpur river, about 48 miles east-north-eastward of the mouth of Rabnabad channel. A shoal, over which depths of 15 feet (4^m6) were reported in 1887, lies about 16 miles eastward of D'Apres shoal.

- 50 Vessels from westward proceeding to Chittagong are recommended to keep well southward after passing Western Channel light-vessel (Chart 814) until reaching the meridian of $91^{\circ} 30' E.$, when course may be shaped north-eastward and a landfall made in the vicinity of the prominent white cliffs, about 4 miles south-south-eastward of Cox's
55 Bāzār (page 262).

Charts 829, 70.

Chart 859.

Tidal streams.—In depths of 5 fathoms (9^m1) and less, there is always a swell during the first half-hour of the stream of the rising tide.

Near D'Apres shoal, the rate of the tidal stream is about 4 knots. 5

In the offing, about 40 miles south-westward of D'Apres shoal, the tidal stream continues to run northward and north-eastward for one hour after high water, and south-south-westward and south-westward for 1½ hours after low water. At springs, the streams run northward and southward, respectively; at neaps, they gradually turn in a clock- 10
wise direction. In the fine season, more westerly than easterly set is experienced. The estimated rate of the stream of the falling tide at springs is from 4 to 6 knots, and at neaps, about 2½ knots.

Charts 829, 859.

Meghna river.—Bore.—Storm wave.—Meghna river is the outlet 15
of the main volume of the waters of the Ganges and Brahmaputra rivers, described on page 12; it enters the sea through four principal mouths, the Tetulia river, the Shāhbāzpur river, the Hātia river and Sandwip channel.

Tetulia river, which has not been surveyed, flows between the main- 30
land and the island of Dakhin Shāhbāzpur close eastward of it.

Shāhbāzpur river, which has not been closely surveyed, flows between Dakhin Shāhbāzpur on the west and the Hātia islands, comprising a group of islands separated by narrow creeks, on the 35
east.

Hātia river, which has not been surveyed, flows between the Hātia islands and Sandwip island.

Sandwip channel, between Sandwip island and the mainland eastward of it, is closed by sandbanks.

For some years Meghna river has shown a tendency to shift its 30
channel gradually westward, and near Noākhāli, the mainland was reported, in 1886, to have advanced 4 miles seaward in 23 years. In 1929, the southern end of Hātia island was reported to be situated near the parallel of 22° 09' N.

Navigation is practicable for vessels of 10 feet (3^m0) draught as far 35
as Nārāyanganj (chart 748b), but it is dangerous between February and November, when at spring tides a heavy bore is experienced in the lower parts of the river. The river is navigated by river steamers and native boats all the year round, but the navigation is difficult and dangerous owing to the sea set up at high water, and at low water to 40
snags and shifting banks; the most favourable time for navigation is between November and February.

Owing to the continual alteration in the channels of Meghna river, no useful directions for its navigation can be given.

Meghna river should not be attempted without local knowledge. 45
Native pilots, who are regularly employed in the coasting trade, can be obtained at Chittagong (*Lat.* 22° 19' N., *Long.* 91° 49' E.).

Sandwip island, the largest of the numerous islands at the entrance to the Meghna river, is low and fertile. The coconut palm flourishes and sugar cane is cultivated to a great extent. The village of Sandwip 50
is situated in the southern part of the island, about 1½ miles within the south-western coast; vessels with local knowledge may obtain anchorage off the coast abreast the village. There is regular sea communication with Chittagong.

Chart 70.

Charts 829, 859.

Sandwip island and Hâtia island are particularly subject to inundation by storm waves.

Chart 748b.

- 5 The bore in the outer channels of the Meghna river is very strong for four days at spring tides, and its influence is felt to a little beyond Ilsa river or about 50 miles below Nārāyanganj. Advancing with violence as a high-crested wave, the Sandwip channel bore meets another passing up between Hâtia and Sandwip islands, and off the
10 north-western end of Siddi, an island at the north-eastern end of Hâtia river, forms a dangerous whirl. Between November and February the bore is not so high, and is not considered dangerous.

At the time of the equinoxes, especially with a southerly wind, the bore attains its greatest development, when it advances like a wall,
15 topped with foam, estimated to be nearly 20 feet (6^m1) high, at the rate of 15 knots. In a few minutes the wave has passed, and with its passage the stream changes from outgoing to ingoing.

The bore was observed from an anchorage at Hâtia bar, at three days after the new moon, extending completely across Shāhbāzpur river,
20 being from 3 to 4 feet (0^m9 to 1^m2) in height on the shoal flats, but somewhat less in greater depths and only breaking occasionally; its estimated rate of travel was from 5 to 6 knots and it is probable that it is comparatively slight in this river.

A storm wave, which occasionally sweeps up Meghna river in the
25 wake of cyclones, is even more dangerous than the bore; it is also most liable to occur at the break of the monsoons in May and October, and the most disastrous on record occurred on the night of 31st October, 1876, when two or three waves came on in succession, flooding, in one moment, the entire country, and destroying, on the islands of Sandwip
30 and Hâtia and a portion of the mainland, about 100,000 persons.

Chandpur is situated on Chandpur creek, at the junction of Meghna river and a channel from the Dakatia river.

Fresh water and provisions can be obtained.

Nārāyanganj is situated on the left bank of the Lakhya river, a few
35 miles above its junction with Meghna river.

Chart 859.

SOUTHERN PART OF SANDWIP CHANNEL.—Coast.—

A white sandy beach fringes the eastern shore of Sandwip channel between a position eastward of the northern end of Sandwip island and
40 the mouth of Karnaphuli river, about 27 miles south-south-eastward.

Sitākund mountain, 1,155 feet (352^m0) high is situated about 14 miles eastward of the northern end of Sandwip island and about 3 miles inland; from this mountain, a ridge of hills runs south-south-eastward roughly parallel with the coast, for about 18 miles.

- 45 Nagarkhāna (Nagarkona), a hill 289 feet (88^m1) high, is situated about 17 miles south-south-eastward of Sitākund mountain, and about 1½ miles farther southward, at the southern end of the ridge and close northward of the town of Chittagong, is Fakir hill, 239 feet (72^m8) high. Fakir hill is surmounted by a black pillar, 20 feet (6^m1) in
50 height, known as Goods pillar.

Charts 84, 859.

APPROACHES TO KARNAPHULI RIVER.—Depths.—The

Charts 829, 70.

Charts 84, 859.

entrance to Karnaphuli river lies between Patenga point, situated about $7\frac{1}{2}$ miles southward of Fakir hill, and Norman's point (*Lat. $22^{\circ} 12' N.$, $Long. 91^{\circ} 48' E.$*), about $1\frac{1}{2}$ miles south-south-eastward. Within a distance of about 70 miles south-south-westward of the entrance, the depths are less than 10 fathoms (18^m3), except for a narrow channel which, with depths of from 11 to 18 fathoms (20^m1 to 32^m9), lies near the coast, its northern end being about 30 miles southward of Patenga point and about 3 miles westward of the southern end of Ketubdia island (page 260). 5 10

On the western side of the approach from south-south-westward, depths of less than 5 fathoms (9^m1) extend southward and south-eastward from the flats off the mouths of Tetulia, Shāhbāzpur and Hātia rivers (page 251), and on the eastern side of this approach are South patches, North patches and Dolphin shoal, *see* pages 260 and 261. 15

Radio D.F. station.—Radiobeacon.—A radio direction finding station is situated close northward of Chittagong, about 8 miles northward of Patenga point.

A radiobeacon transmits from Chittagong airport, situated on the western bank of Karnaphuli river about $2\frac{1}{4}$ miles north-north-eastward 20 of Patenga point.

Lights.—Caution.—The light-vessel marking South patches, about 47 miles southward of Patenga point, and the lighthouse on Ketubdia island, about 21 miles southward of the same point, are described on pages 261 and 260, respectively. 25

A light is exhibited at an elevation of 52 feet (15^m8) from a white mast surmounted by a black ball, 80 feet (24^m4) in height, situated about 2 cables north-eastward of the extremity of Patenga point.

Norman's point light is exhibited, at an elevation of 55 feet (16^m8) from a white brick tower with a black horizontal band, 47 feet (14^m3) in height, situated about $1\frac{1}{2}$ miles southward of Norman's point. 30

During the North-east monsoon it occasionally happens that small fog banks or thick mists occur on this coast, causing the lights in some instances to appear a deep red colour, and in others, entirely obscuring them. 35

Buoys.—A black conical buoy is moored about 15 miles west-north-westward of Patenga point and about 8 miles south-south-eastward of the southern extremity of Sandwip island, and a conical buoy painted in black and white vertical stripes is moored about $5\frac{1}{2}$ miles farther south-eastward and about $10\frac{1}{2}$ miles westward of 40 Patenga point. These buoys are moved as the channel changes.

Tidal streams.—Caution.—The tidal streams in this part of the Bay of Bengal set northward and southward parallel with the coast, with a rate at springs of from 5 to 6 knots; in hazy weather vessels have been swept past the entrance to Karnaphuli river by the north- 45 going stream, and set upon the sands westward of Sandwip island, without sighting either Kutubdia island light by night, or the land by day.

Anchorage.—In case of necessity, anchorage may be obtained anywhere off the entrance to Karnaphuli river, in depths of about 50 5 fathoms (9^m1), good holding ground.

Recommended track.—A track recommended for deep-draught vessels, passing at a distance of from $1\frac{1}{2}$ to 4 miles offshore, in depths of not less than 5 fathoms (9^m1), is indicated by pecked lines on chart 84.

Charts 829, 70.

Chart 84, 859.

Directions.—Whatever the state of the weather or time of the year, but especially from April to September, the greatest care is necessary in approaching Karnaphuli river.

- 5 Even with favourable weather and when the positions is known, strict attention to the depth, as well as to the course and distance made good over the ground, is necessary. The assistance obtainable from the radio direction finding station at Chittagong and from the radiobeacon at Chittagong airport (*Lat. 22° 16' N., Long. 91° 50' E.*)
 10 should also be borne in mind. See also "Cautions" on page 250 and above.

If the position is doubtful and there is a strong north-going stream, it is as well to anchor, to avoid being set on the shoals extending from Sandwip island and Meghna river entrance, which latter may extend
 15 farther southward than the chart indicates.

Chart 859.

- If approaching from south-westward and cloudy weather prevents observations being obtained, it would be well for vessels to make the white cliffs southward of Cox's Bazar (page 262), and then pass between
 20 South and North patches (pages 260, 261) and outside Dolphin shoal (page 260), sounding frequently and making allowance for tidal streams.

Charts 84, 829.

- KARNAPHULI RIVER.—Port of Chittagong.**—Karnaphuli river is the most important river in Chittagong district ; it is navigable
 25 throughout the year by craft of about 4 tons to Kasalang, a distance of about 100 miles above its mouth. About 20 miles above Kasalang, navigation is stopped by Barkal rapids. The effect of the tide is felt in the river as far as Chandragona and the stream is sluggish, except during the rains, when it is rapid.

- 30 The port of Chittagong is situated on the right bank of the river about 10 miles above the entrance ; it handles most of the trade of East Pakistan and in 1951-52 was greatly extended.

Chart 84, plan of Karnaphuli river.

- Entrance.—Aspect.**—The entrance to the river lies between a
 35 training wall retaining a sand and mud flat which extends about $4\frac{1}{2}$ cables south-westward from Patenga point, and a stone apron which forms an extension south-westward of another training wall retaining mud flats on the south-eastern side of the entrance, and which terminates about 11 cables north-westward of Norman's point.

- 40 Between Norman's point lighthouse and Norman's point, the coast is bordered by sandhills, from 10 to 18 feet (3^m0 to 5^m5) high, and is fringed by a sand flat extending about a quarter of a mile offshore.

- Between Norman's point and the stone apron mentioned above, there are extensive mud flats, in the centre of which, between half a mile
 45 and $1\frac{1}{2}$ miles northward of the point, lies Middle island. The greater part of this island is awash at high water spring tides during the South-west monsoon ; the inner end is covered with low trees and bushes, and the remainder with coarse grass and sand.

- Four Tree hill, 127 feet (38^m7) high, with four trees on it, lies about
 50 $2\frac{1}{4}$ miles east-north-eastward of Norman's point ; from a distance, it appears to form the southern end of a plateau, of which Juldia hill, about $1\frac{1}{2}$ miles farther north-north-westward, forms a part.

Patenga point is low, flat and cultivated in places, with few trees

Charts 84, 859, 829, 70.

Chart 84, plan of Karnaphuli river.

on it ; a grassy plain extends some miles inland from the point and the latter is fronted by a sand and mud flat extending about half a mile south-westward.

Depths.—The normal depth on the outer bar and Gupta crossing (Lat. $22^{\circ} 16' N.$, Long. $91^{\circ} 50' E.$), about 3 miles north-eastward of the river mouth, is $13\frac{1}{2}$ feet (4^m1).

Outer bar.—**Buoyage.**—**Beacons.**—A black conical light-buoy, exhibiting a *white flashing* light, is moored about $8\frac{1}{2}$ cables south-westward of Patenga point, and about one cable eastward of the outer bar.

A red can buoy is moored about $5\frac{1}{2}$ cables south-westward, and a black conical buoy is moored about $2\frac{1}{2}$ cables southward, of Patenga point.

Leading beacons have been established for a channel across the outer bar. The front beacon consists of a pole surmounted by a white disc, 25 feet (7^m6) in height, situated about 3 cables north-eastward of Patenga point ; the rear beacon consists of a pole surmounted by a white diamond, 45 feet (13^m7) in height, situated about $1\frac{1}{2}$ cables north-eastward of the front beacon. These beacons in line, bearing 037° , lead across the outer bar in a least charted depth of 17 feet (5^m2).

A confused and dangerous sea breaks on the outer bar during strong south-westerly winds.

A dredger is employed on the bars to maintain constant depths throughout the year as far as is possible. When the dredger is at work on the outer bar, all inward-bound vessels shall display a black ball at the foremast head 15 minutes before approaching the outer bar. For an exception to this, *see* under Tidal signals, below.

Signal station.—**Storm and weather signals.**—**Tidal signals.**—A signal station with a flagstaff, the top of which has an elevation of 180 feet (54^m9), is situated on Juldia hill and is a good mark when approaching from seaward.

The extended system of storm and weather signals, *see* pages 30-34, is displayed from Juldia signal station flagstaff.

A tidal semaphore, which indicates by day the height of water above the tidal datum, is situated on Juldia hill.

This semaphore, which is visible from the jetties at Chittagong, has three arms, the upper of which indicates fathoms, the middle feet, and the lower inches. The diagram (*see* page 241) shows the position of the semaphore arms and their meanings, as viewed from a vessel approaching from seaward.

A black ball is displayed on top of the semaphore at high water, and dropped when the tide has fallen 3 inches below high-water level.

Vessels closing the outer bar in order to ascertain the rise of tide as indicated by the semaphore, will not display a black ball at the foremast head.

Tide lights for night pilotage are exhibited, from two framework masts, each 161 feet (49^m1) in height. Three lights, vertically disposed, 18 feet (5^m5) apart, exhibited from each mast, indicate the rise of the tide in feet and inches. These lights are visible both from the jetties and from outside the outer bar.

Pilotage.—Pilotage is compulsory for merchant vessels. The entrance to the river is constantly changing and no vessel should

Chart 84, plan of Karnaphuli river.

attempt to enter without a pilot. A sea-going pilot launch is stationed off Juldia. Vessels should close the entrance to a distance of about one mile south-westward of the outer bar light-buoy where the pilot launch will meet them. The Harbour-master boards vessels about half a mile below Salt Colas (page 257) and takes them to their berth.

Vessels can be piloted up and down the river between the outer anchorage and the jetties at Chittagong (*Lat.* $22^{\circ} 19' N.$, *Long.* $91^{\circ} 49' E.$) at times of high water between sunset and sunrise.

At spring tides during the cold weather season, vessels drawing 25 feet (7^m6) can enter or leave the port.

River entrance to Chittagong.—The training wall retaining the mud flats surrounding Middle island joins the left bank of the river about $2\frac{1}{4}$ miles north-north-eastward of Norman's point; embankments have been constructed here to prevent inundation as there are several small villages on this bank.

At Gupta point, about 3 miles north-eastward of the entrance, the river turns sharply from north-eastward to west-north-westward. A training wall borders the right bank of the river between a position about $1\frac{1}{2}$ miles north-eastward of Patenga point and Gupta crossing; this wall partly retains Active spit, a mud flat which dries 3 feet (0^m9), but parts of the spit on which the depths are less than 3 fathoms (5^m5), extend as much as $1\frac{1}{2}$ cables eastward of the wall. Opposite Gupta point, another wall borders the left bank, which here is the north-eastern side of the river, and guards Gupta crossing, northward and north-westward of Active spit.

Between Gupta crossing and Chittagong, about 4 miles northward, the left bank of the river becomes low and swampy, but is cultivated; mud islands, known as chars, the largest of which are Gupta and Lukia islands, lie off this bank with a boat passage at high water between. Above Sandar ghât, situated at Chittagong on the right bank, which here is on the northern side of the river, the channel narrows and shoals.

Buoys.—Caution.—The channels in the river are marked by black conical buoys on the starboard hand when entering, and by red can buoys on the port hand when entering.

Leading beacons have been established for the inner bar. The front beacon consists of white battens and is situated about $6\frac{1}{2}$ cables northward of Juldia flagstaff; the rear beacon is Coombs pillar, painted white, having an elevation of 125 feet (38^m1) and situated about 2 cables north-eastward of the front beacon. These beacons in line, bearing 054° , lead across the inner bar in a least charted depth of 15 feet (4^m6).

Leading beacons have been established for the channel abreast Active spit. The front beacon is a pole, surmounted by a white triangle, 14 feet (4^m3) in height, situated about $1\frac{1}{4}$ miles northward of Juldia flagstaff; the rear beacon is a pole, surmounted by a white cross and ball, 50 feet (15^m2) in height, about $1\frac{1}{4}$ cables north-north-eastward of the front beacon. These beacons in line, bearing 025° , lead from the line of the inner bar leading beacons to the commencement of the westerly bend in the river.

Leading beacons have been established for Gupta crossing. The front beacon is a white post surmounted by a drum, 15 feet (4^m6) in height, situated about 16 cables northward of Juldia flagstaff; the

Chart 84, plan of Kanraphuli river.

rear beacon is a white mast surmounted by a drum. These beacons in line astern, bearing 115° , lead across Gupta crossing in a least charted depth of 15 feet (4^m6).

Leading beacons have been established close southward of the Railway jetties at Chittagong; these beacons in line, bearing 026° , mark the eastern side of the fairway abreast the northern part of Gupta island. 5

The depths on the bars and in the river are subject to constant change and the buoys and beacons are moved as necessary. 10

Tide gauges.—A tide gauge, marked in 3-inch (0^m8) divisions, by which the tidal signals governing the entry and departure of vessels are made, is situated on the edge of the mud bank, about 6 cables north-north-westward of Juldia flagstaff. There is also a tide gauge at Salt Colas, on the right bank of the river, about $5\frac{1}{2}$ miles above Gupta crossing, and another at Sandar ghât, about 2 miles farther east-north-eastward. 15

Storm and weather signals.—The extended system, *see* pages 30-34, is displayed from a flagstaff at Kumar khâl (*Lat.* $22^{\circ} 18' N.$, *Long.* $91^{\circ} 48' E.$), close below Salt Colas. 20

Tidal streams.—About half a mile westward of the outer bar, the tidal stream sets north-north-westward with the rising tide and south-south-eastward with the falling tide. 25

The tidal stream turns about $1\frac{1}{2}$ hours after high and low water near Juldia, and $1\frac{1}{2}$ hours after high and low water at Chittagong. Under ordinary conditions the rate of the tidal streams is about 2 knots at neaps, and from 3 to 4 knots at springs. 30

During freshets, from June to October, the outgoing stream has been known to reach a rate of 10 knots, and, with such conditions, there may be no ingoing stream for perhaps a week. In November, the ingoing stream has been observed to run for 4 hours and the outgoing stream for 8 hours. 35

Anchorage.—Vessels can anchor temporarily in certain reaches of the river whilst bound up or down, but, it should be noted, there is only swinging room at or near high water, and then only with the assistance of the engines. Vessels cannot remain at anchor at low water. 40

Quarantine anchorage.—Vessels with plague or other infectious diseases on board, must anchor off Coombs pillar until inspected by the Health Officer. 45

Directions.—The best time to arrive at the anchorage outside the river entrance is 3 hours before high water in order to enter and proceed alongside at Chittagong on the flood stream. At springs, the flood stream is strong and apt to sweep vessels northward and westward of the river entrance. 50

It is desirable for vessels to arrive off the jetties at Chittagong on the last of the flood so that they can turn on an anchor before proceeding alongside. The channel below the jetties is quite wide enough for this to be done and H.M.S. *Emerald*, 570 feet (173^m7) in length, turned with ample room to spare. The length of vessels using the port is, however, governed by the length of the berths, the longest being 560 feet (170^m7) in length with a depth of 26 feet (7^m9) alongside. 55

Vessels can be moored on the flood or ebb stream as desired by the master, subject to the approval of the Deputy Conservator.

Chart 84, plan of Karnaphuli river.

Jetties.—The railway jetties, situated about $1\frac{1}{2}$ miles south-westward of the middle of the waterfront at Chittagong, are 3,120 feet (951^m0) long, with depths alongside of 26 feet (7^m9); they provide 5 berths for seven ocean-going vessels and are equipped with a number of cranes with lifting capacities of from $1\frac{1}{4}$ to 10 tons. There are two berths at Salt Colas, about a quarter of a mile south-westward of the railway jetties; No. 2 berth, the south-western of the two, is formed by three equidistant concrete spurs and has a length of 300 feet (91^m4) and depths of 26 feet (7^m9) alongside; No. 1 berth is a wooden jetty 10 and is suitable only for lighters.

Moorings.—There are a number of fixed moorings situated abreast and below Sandar ghât, and about one cable below the Railway jetties is a berth with head and stern buoys which can accommodate vessels of 15 450 feet (137^m2) in length and 22 feet (6^m7) draught. There are also some swinging moorings for small vessels which are laid as required; they are mostly used by Port Trust and Government vessels.

Chittagong.—The town of Chittagong (*Lat.* $91^{\circ} 50' N.$, *Long.* $22^{\circ} 20' E.$) is the chief port of East Pakistan and is the administrative 20 headquarters of the district of the same name. The European houses are situated on hills from 150 to 200 feet (45^m7 to 61^m0) high, covered with vegetation and in the hollows are native huts amongst fruit trees. In 1948, the population was over 100,000.

The native town is considered unhealthy on account of malaria. 25 The most unhealthy time of the year is September or towards the close of the rainy season when fever is prevalent. In April and May, epidemics of smallpox and cholera are common. An easterly wind, if of any continuance, is reported to be unhealthy.

During the South-west monsoon the atmosphere is frequently saturated with moisture, causing heavy dew at night and occasionally dense 30 fogs. From November to February, thick morning fog is often experienced on the river between sunrise and about 0900. For local winds, see page 61.

Port facilities.—As a result of the partition of the sub-continent 35 into India and Pakistan, the port of Chittagong became heavily congested. This congestion was removed by increasing the number of berths available for ocean-going vessels and by regulating the numbers of vessels visiting the port, a condition only possible since December, 1950, when the port of Chalna anchorage (page 249) was opened and 40 became the second port of East Pakistan. In 1952, the port of Chittagong could accommodate 15 ocean-going vessels as opposed to 4 on the eve of partition, and the annual handling capacity of the port had been increased from 500,000 to more than 2,000,000 tons.

Moderate stocks of coal, fuel oil and diesel oil are maintained.

45 Coal is supplied from railway trucks alongside the Railway jetties. Oil is obtained at Gupta khâl, about one mile above Gupta crossing, where there is a berth with head and stern buoys for vessels up to 470 feet (143^m3) in length and 25 feet (7^m6) draught. Oil is embarked at a rate of about 60 tons per hour.

50 Fresh water is laid on to the jetties and can be supplied in very limited quantities to vessels in the stream. Two tugs of 800 and 220 H.P., respectively, are available.

Repairs to vessels can be undertaken and there is a patent slip; for details, see Appendix I, page 488.

Charts 84, 859, 829, 70.

Chart 84, plan of Karnaphuli river.

A gridiron, 100 feet (30^m5) in length and 20 feet (6^m1) in width, is available for small vessels up to 150 tons.

There is a hospital with 200 beds.

There is regular sea communication with Indian ports and with 5
Rangoon. Chittagong is the terminus of the Eastern Bengal railway.

There is regular air service between Chittagong airport, Dacca and Calcutta. The airport is situated about 2½ miles north-north-eastward of Patenga point.

The principal exports are wax, jute, tea, hides, cotton, rice, poultry 10
and livestock; and the chief imports are salt, mineral oil, machinery, rice and coal.

In 1950-51, about 1,500,000 tons of cargo was handled at the port.

Radio station.—There is a radio station at Chittagong, *see* page 38.

Climatic table.—*See* page 78.

15

*Charts 84, 859.***NORMAN'S POINT TO ELEPHANT POINT.—Coast.—**

Beacons.—From Norman's point, the coast trends south-south-eastward for about 15½ miles to Cuckold point (*Lat.* 21° 57' N., *Long.* 91° 53' E.). Between Norman's point and the northern entrance 20
point of Sangu river, about 5½ miles south-south-eastward, the coast is low, wooded and lined with sandhills 15 feet (4^m6) high in places; a drying mudflat extends about a quarter of a mile offshore along this stretch of coast. A beacon, painted in black and white, the top of which has an elevation of 50 feet (15^m2), stands on the coast about 25
1½ miles north-westward of the northern entrance point of Sangu river.

Low-lying sandhills back the northern entrance point of Sangu river, and it is fronted by a sand and mud spit which dries in places and extends about 2½ miles southward from the point. The entrance to 30
the river, though almost filled with sandbanks, appears to be about 3 miles wide when these banks are covered. The entrance channel, entered about 3 miles southward of the northern entrance point, has a least depth in the fairway of 9 feet (2^m7), and the river is navigable throughout the year by large native boats. 35

Between Sangu river entrance and Cuckold point, the coast is low and wooded and, except for occasional characteristic trees, the positions of which can best be seen on the chart, without any distinctive natural features. Groups of sand dunes back the coast, rising to elevations of from 10 to 25 feet (3^m1 to 7^m6) about 2 miles eastward of the entrance 40
to the river. A drying mud flat which covers at low water during the South-west monsoon, fronts this stretch of coast and extends as much as 2 miles offshore.

A beacon, painted in black and white, the top of which has an elevation of 50 feet (15^m2), stands on the coast about 2½ miles south-south-eastward of the northern entrance point of Sangu river, and another beacon stands on the coast about 4½ miles farther southward. 45

The 5-fathom (9^m1) contour line trends in a general west-south-westerly direction from a position abreast the entrance channel to Sangu river, and there is a 4½-fathom (8^m7) patch about 6½ miles 50
west-north-westward of Cuckold point and a shoal with a least depth of 4½ fathoms (8^m7) lies a similar distance westward of the same point.

Charts 829, 70.

Chart 859.

Kutubdia island.—Light.—Beacon.—For about 30 miles southward of Cuckold point the coast is intersected by numerous shallow streams and is fronted by a number of low islands. Kutubdia island, the north-western and outermost of these islands, is low, flat and covered with trees; it lies with its northern point about $1\frac{1}{2}$ miles southward of Cuckold point, and is about 12 miles long in a north and south direction. Being liable to inundation, its coasts are protected from the sea by embankments.

10 A light is exhibited, at an elevation of 121 feet (36^m9), from a brick tower 136 feet (41^m4) in height, the lower part of which is painted red and the upper part in red and white horizontal bands, situated on the western coast of the island, about 5 miles south-south-westward of Cuckold point.

15 A beacon (*Lat.* $21^{\circ} 45' N.$, *Long.* $91^{\circ} 49' E.$) stands near the southern point of Kutubdia island, about $7\frac{1}{2}$ miles southward of the lighthouse.

Off-lying dangers.—Buoy.—Dolphin shoal, which has a least depth of 3 fathoms (5^m5) over it, lies between 3 and 5 miles west-south-westward of Kutubdia lighthouse, and another shoal with a least depth of $4\frac{1}{2}$ fathoms (8^m2) over it, lies about 2 miles west-south-westward of the southern end of Dolphin shoal. There are depths of from $5\frac{1}{2}$ to 7 fathoms (10^m1 to 12^m8) in the fairway of the channel between Dolphin shoal and Kutubdia island.

25 A white conical buoy, surmounted by a small black cage, is moored about $1\frac{1}{2}$ miles northward of the shoalest part of Dolphin shoal; the buoy is liable to be washed away.

North patches consist of a number of shoals with depths over them of from $1\frac{1}{2}$ to $3\frac{3}{4}$ fathoms (2^m7 to 6^m9), hard sand, which extend about 30 12 miles southward from a position about 5 miles westward of the beacon near the southern end of Kutubdia island. In 1928, the least depth obtained on these shoals was 10 feet (3^m0), but at the same time it was reported that there were probably less depths over them than were shown on the chart.

35 Two 5-fathom (9^m1) patches lie between Dolphin shoal and North patches.

There are depths of from $5\frac{3}{4}$ to 17 fathoms (10^m5 to 31^m1) in the fairway of the channel between North patches on the west, and the sands which extend from the southern end of Kutubdia island and from the 40 western side of Maishkāl island southward of it, on the east; the tidal streams, however, set at a great rate through this channel and it should not be attempted without local knowledge.

Anchorage.—Anchorage may be obtained in depths of 7 fathoms (12^m8), with Kutubdia lighthouse bearing 068° , distant one mile; the 45 anchorage should be approached southward of Dolphin shoal. Although moderately well protected, the tidal streams run as strongly at this anchorage as outside the shoals.

Kutubdia island to Cox's Bāzār.—Islands and dangers.—Between the southern end of Kutubdia island and a position on the 50 coast abreast Cox's Bāzār, about 18 miles south-south-eastward, the outermost of the numerous islands fronting the coast are Matarbāri (Mattabari) island, situated south-eastward of Kutubdia island and separated from it by a channel about 2 miles wide, and Maishkāl island, which lies close southward of Matarbāri island with its south-eastern

Chart 859.

point separated from the mainland about $1\frac{1}{2}$ miles farther south-eastward, by Maishkāl channel.

The northern, western and southern sides of Maishkāl island are low-lying and fringed by mangroves, but a range of low hills about 300 feet (91^m4) high, runs through the centre of the island and along its eastern coast. Garamchari (Garamchori), a hill near the middle of the eastern part of the island, is 288 feet (87^m8) high, but as the range is somewhat uniform, it is not very distinctive. There are sandhills from 10 to 25 feet (3^m0 to 7^m6) high along the southern coast of the island. Adināth Bāzār is situated near the southern end of the east coast of the island, and close northward of it is Maishkāl bluff (*Lat.* $21^{\circ} 32' N.$, *Long.* $91^{\circ} 58' E.$), 200 feet (61^m0) high, which is prominent.

Sonādia island, a narrow island about 4 miles long in a north-westerly and south-easterly direction, lies with its north-western extremity about 2 miles west-south-westward of the south-western point of Maishkāl island; it has white sandhills from 5 to 15 feet (1^m5 to 4^m6) high, and there are two prominent palm trees in the village of Sonādia at about one mile from the south-eastern end of the island.

Sonādia island stands on a bank which dries in patches and extends about $1\frac{1}{2}$ miles seaward from its south-western side; the sea breaks heavily on this bank during the north-going tidal stream. The area between the island and the southern coast of Maishkāl island is nearly filled by a sand and mud flat which dries in places.

Lattādiā island, about one mile northward of the north-western end of Sonādia island, and Laldia island, about one mile eastward of its south-eastern end, are two sandy islets on which are small fishing villages. There are sandy ridges about 5 feet (1^m5) high on Laldia island and also on a small unnamed islet lying about $1\frac{1}{4}$ miles west-south-westward of it. In 1948, a beacon, consisting of a white pole surmounted by a basket, stood on Laldia island.

Hamidardia (Red Crab) island is a sandy island separated from the south-eastern point of Maishkāl island by a mangrove swamp interspersed with small creeks, and which covers at high water; the fishing village of Hamidardia is situated at the north-eastern end of the island.

Charts 3493, 859.

Rupadia sands, which lie about 2 miles south-eastward of Sonādia island, form the south-eastern part of the bank fronting that island; they cover at high water except for a small patch awash at the northern end and another at the southern end. Rupadia sands lie on the north-western side of the seaward entrance to Maishkāl channel, which leads between Maishkāl island and the mainland, and also to Bāghkhāli river and Cox's Bāzār.

Chart 859.

Off-lying shoals. — Light-vessel. — Fog signal. — Buoy. — South patches, with a least depth of $3\frac{1}{2}$ fathoms (6^m4), lies about 11 miles west-south-westward of the north-western end of Sonādia island.

A light-vessel, painted red with the name in white letters on the sides, and with one mast with a red ball at the masthead as a daymark, is moored about one mile west-south-westward of the shoalest part of South patches. A light is exhibited, at an elevation of 45 feet (13^m7), from a light-structure on the vessel. A fog signal is sounded from

Chart 859.

the light-vessel. The light-vessel is periodically replaced by a light-buoy, exhibiting a *white group flashing* light showing *three flashes every ten seconds*.

- 5 A can buoy, painted red and marked with a white W, is moored about 7 cables eastward of the light-vessel as a watch buoy.

Shoal patches with depths of from $3\frac{3}{4}$ to $4\frac{1}{2}$ fathoms (6^m9 to 8^m2) over them, lie between 10 miles westward and 15 miles west-south-westward, of South patches; in 1907, Trifels shoal, a $5\frac{1}{2}$ -fathom (10^{m1}) patch, was reported to lie about 14 miles south-westward of the southern end of South patches. In 1909, a depth of 12 fathoms (21^{m9}), sand, known as Kohinur, with depths of 28 and 30 fathoms (51^{m2} and 54^{m9}) close-to, was reported in a position about 20 miles southward of the southern end of South patches (*Lat.* $21^\circ 27' N.$, *Long.* $91^\circ 39' E.$).

Chart 3493.

Cox's Bāzār.—Cox's Bāzār, about 4 miles southward of the south-eastern extremity of Maikhāl island, is situated on a low range of sandhills on the mainland, and on the western bank of Bāghkhālī river, which flows into Maikhāl channel about $1\frac{1}{2}$ miles northward of the town; Cox's bluff, about half a mile southward of the town, rises steeply to an elevation of 160 feet (48^{m8}), from a long open beach which extends northward to the mouth of Bāghkhālī river and forms the south-eastern entrance point of Maikhāl channel.

- 25 **Entrance to Maikhāl channel.**—**Dangers.**—**Buoy.**—Inner spit, which dries in patches, fronts the long sandy beach and extends about $2\frac{1}{2}$ miles westward and north-westward of Cox's bluff; the sea breaks heavily on this spit especially during the flood tide. Shoals on which the sea breaks in places extend as much as $1\frac{1}{2}$ miles offshore for a distance of about 4 miles south-south-eastward of Inner spit. There is a boat channel inshore of the breakers which passes close to the coast.

Outer spit, which is partly awash, lies between 3 and $4\frac{1}{2}$ miles westward of Cox's bluff; the sea breaks on this spit at all stages of the tide except slack water.

- 35 The principal channel into Maikhāl channel, leading to an anchorage off the mouth of Bāghkhālī river, lies between Inner and Outer spit over a bar of sand, which probably shifts during the South-west monsoon. In 1944, there was a least depth of 8 feet (2^{m4}) in this channel, the entrance to which was marked by a small black buoy, liable to be washed away, moored about 3 miles west-south-westward of Cox's bluff.

Chart 859.

There is another channel into Maikhāl channel, the entrance to which lies between Outer spit and Rupadia sands; in 1942, there was a least depth of 5 feet (1^{m5}) on the bar across this channel.

- 45 There are generally heavy rollers off the entrances to both channels, which, within depths of 3 fathoms (5^{m5}), occasionally break on parts of the bar.

Middle shoal, composed of sand and mud, with depths of less than 2 fathoms (3^{m7}) over it, lies on the north-western side of the fairway of Maikhāl channel about one-third of the distance between Hamidardia island and the mainland about $1\frac{1}{2}$ miles south-eastward of it; Middle sands, which dry in places, lie near the south-western end of Middle shoal and about one mile eastward of Laldia island.

Bāghkhālī river, which enters Maikhāl channel about $1\frac{1}{2}$ miles

Chart 859.

south-south-eastward of Hamidardia island, is narrow and shallow ; it nearly dries in places.

Charts 3493, 859.

Anchorage.—Deep-draught vessels may obtain anchorage southward of the entrance to the channel between Inner and Outer spit, in a depth of 5 fathoms (9^m1), sand and mud, with Cox's bluff bearing 055°, distant 3½ miles. 5

Light-draught vessels can anchor in a depth of about 3 fathoms (5^m5), sand and mud, with Cox's bluff (*Lat.* 21° 26' N., *Long.* 91° 58' E.) 10 bearing 043°, distant about 2½ miles, but the area eastward of this position has not been surveyed recently and, as there have been major changes in the positions of the channels and sand banks in the vicinity, caution is necessary.

Vessels which can cross the bar may anchor off the mouth of Bāghkhāli river in Maishkāl channel, in a depth of 5½ fathoms (10^m1), mud. 15

Reliable pilots cannot be obtained and the bar and channel should be examined and buoyed before entering, as they are liable to change during the monsoon.

Directions.—The following directions were those employed in 1942 20 for small vessels proceeding through the channel between Outer and Inner spit to the anchorage off Bāghkhāli river.

The best time to enter is at about half flood when the breakers will give a good indication of the edges of the shoals. Vessels should approach with Cox's bluff bearing 060°, passing about one cable 25 south-eastward of the small black buoy and when the village on Laldia island bears 355°, it should be steered for between the breakers on that bearing. (In 1948, a white pole beacon surmounted by a basket, stood on the islet and made a good mark to steer for.) When a conspicuous tree, situated on the eastern side of Maishkāl channel, about 2½ miles 30 east-south-eastward of Maishkāl bluff, bears 052°, course should be altered to starboard and the tree should be kept bearing 052° until the anchorage off Bāghkhāli river is reached.

Chart 3493.

Town.—**Storm and weather signals.**—In 1931, the population 35 of Cox's Bāzār was 5,018. A few provisions may be obtained. There is regular sea communication with Chittagong.

The general system of storm and weather signals, *see* pages 30 to 32, is in use at Cox's Bāzār.

Cox's bluff to Elephant point.—**Coast.**—From Cox's bluff the 40 coast trends south-south-eastward for about 15½ miles to Elephant point. Red cliffs, about 200 feet (61^m0) high, back the coast from about 4 to 6½ miles south-south-eastward of Cox's bluff, South cliff, the highest and the southernmost of them, having an elevation of 270 feet (82^m3). From seaward, these cliffs appear white when the 45 sun is shining on them and they form a good landmark for vessels approaching Chittagong from southward.

Elephant point, about 9½ miles southward of South cliff, is dominated by a prominent hill, 410 feet (125^m0) high. A ledge of rocks extends about 3 cables westward from the point and there is a depth of 5 fathoms 50 (9^m1) about 6 cables westward of it.

Off-lying shoal.—Reju (Regu) shoal, about 4 miles south-westward of South cliff, has a least depth of 2½ fathoms (5^m0), and is composed of rock and hard sand.

Charts 859, 829, 70.

CHAPTER VII

COAST OF BURMA—ELEPHANT POINT TO PAGODA POINT

Chart 3493.

ELEPHANT POINT TO FOUL POINT.—Coast.—Between Elephant point and Shāhpuri point, about 33 miles south-south-eastward, the coast forms the western side of the Nāf peninsula, a strip of land from 2 to 5 miles wide between Nāf (Naaf) river and the sea. Taungyo taung (Taungnyo or Quoin hill), a hill 880 feet (268^m2) high, stands about 11 miles south-eastward of Elephant point and about 2 miles inland, and a conspicuous hill rises to an elevation of 830 feet (253^m0) about 9½ miles south-south-eastward of Taungyo taung (*Lat.* 21° 03' N., *Long.* 92° 12' E.).

The southern extremity of Nāf peninsula is separated from the mainland by a narrow creek which cuts through the peninsula in a north-north-easterly and south-south-westerly direction and dries in places; it enters the sea about 3½ miles north-westward of Shāhpuri point forming Shāhpuridwip, an island which is low, flat and covered with jungle.

Good marks in this vicinity are North Twins, two conspicuous casuarina trees which stand close within the coast of the mainland about 4½ miles north-westward of Shāhpuri point, and Badar clump, a group of casuarinas about 90 feet (27^m4) high, situated about one mile west-north-westward of Shāhpuri point.

The coast southward of Taungyo taung is backed by Mayu range, the peaks of which rise to elevations of from 1,000 to 2,260 feet (304^m8 to 688^m9); Wetkyein daung (Walkyeing taung), about 11 miles east-north-eastward of Taungyo taung, lies at the northern end of the range, which extends south-south-eastward for about 52 miles, converging gradually towards the coast and terminating about 3 miles northward of Foul point, *see* page 266.

Shāhpuri flat, a bank of sand and mud with depths of from one to 3 fathoms (1^m8 to 5^m5), fronts the coast between Shāhpuri point and a position about 9 miles north-north-westward, and extends as much as 4 miles offshore; the southern part of the flat forms part of a bar across the entrance to Nāf river. A spit, with depths of less than one fathom (1^m8) over it, extends about one mile westward from the coast about 2½ miles west-north-westward of Shāhpuri point; the sea breaks on this spit and there are usually heavy rollers on Shāhpuri flat which often break in depths of 2 fathoms (3^m7).

Off-lying islands and dangers.—St. Martin's reef is a ridge of sunken rocks about 2½ miles long in a northerly and southerly direction,

Charts 821, 829, 70.

Chart 3493.

lying about 10 miles west-south-westward of Shāhpuri point. A rock awash, lies about 6 cables northward of its southern end, and there are several 5-fathom (9^m1) patches about one mile north-north-westward of its northern end. The sea breaks over the reef in heavy weather 5 or with a southerly swell.

St. Martin's islands are a group of one island and two islets connected by drying ledges of sand and rock, situated between 5½ and 9 miles south-south-westward of Shāhpuri point. At the northern end of the large island is North Tall tree (*Casuarina* clump), about 110 feet (33^m5) 10 high; in 1948, a conspicuous tall tree stood about half a mile south-south-westward of North Tall tree, and on other parts and near the southern end of the island, are several casuarina trees.

Good landing may be effected at the northern end of the large island and anchorage may be obtained in depths of about 4 fathoms (7^m3) 15 in the position indicated on the chart, about 4 cables eastward of the landing place.

For dangers south-south-westward and south-eastward of St. Martin's islands, *see* page 267.

Nāf river.—Entrance.—Nāf river is entered between Shāhpuri 20 point (*Lat.* 20° 43' N., *Long.* 92° 22' E.) and Cypress point, a low and sandy point about one mile east-south-eastward. Cypress clump, situated close to the point, consists of casuarina trees about 80 feet (24^m4) high, and in 1948, two prominent brown trees stood close 25 within the eastern bank of the river about 3 cables northward of Cypress point. Best clump, another prominent clump of trees and the most distinctive mark south-eastward of the entrance, is situated about 3 cables south-eastward of Cypress point.

Maungdaw, the principal town on Nāf river, is situated on Tat creek, which branches eastward from the left bank of the river about 30 7 miles above the entrance. The river has been surveyed to a distance of about 9½ miles above Tat creek.

Dangers in approach.—Channels.—Buoy.—The entrance to Nāf river is obstructed by a bar, the north-western part of which is formed by Shāhpuri flat and the south-eastern part, by Cypress sands. 35

Shāhpuri flat, on the north-western side of the entrance is described on page 264.

Cypress sands are a number of ridges with depths of less than 6 feet (1^m8) on them, lying on a bank, which, with depths of less than 3 fathoms (5^m5) over it, extends as much as 6 miles west-south-west- 40 ward of Cypress point; the positions of these ridges are at times indicated by broken water over them.

In 1944, there were two channels across the bar leading to the river entrance; the north-western channel, in which a least depth of 8 feet (2^m4) was reported over the bar, is approached north-westward of St. 45 Martin's islands and entered in a north-easterly direction about 1½ miles northward of these islands, but the channel had not recently been examined in 1944 and less depths than those reported may exist in it.

The south-eastern channel, which is approached eastward of St. Martin's islands, leads in a northerly direction through Patricks gut on 50 the southern side of Cypress sands, and had, in 1944, a least depth of 11 feet (3^m4) on the bar. In 1948, No. 2 red conical buoy, situated about 3½ miles south-south-westward of Cypress point and about one mile northward of the entrance to Patricks gut, marked the eastern

Chart 3493.

side of the channel through Cypress sands; the buoy is removed annually in April and replaced in position towards the end of November.

Tidal streams.—The tidal streams set across the approach to the bar, running northward with the rising tide and southward with the falling tide, at rates of from three-quarters of a knot to one knot at springs.

Nāf river above the entrance.—Buoys.—Beacons.—Northward of the bar, from about 2 miles southward of the river mouth to about 10 4 miles northward of Tat creek, there are depths of from 4 to 8 fathoms (7^m3 to 14^m6) in the fairway of the river with no off-lying dangers.

Northward of the above position, to the limit of that part of the river which has been surveyed, there are several detached sand or mud banks, which dry in patches, with shallow channels between them 15 navigable only by vessels of light draught. Two buoyed channels follow the western and eastern shores of this shoal stretch with least depths in them of 2 fathoms (3^m7) and $1\frac{1}{2}$ fathoms (2^m7), respectively.

The western of these channels, on the eastern side of which there is a narrow wooded island about one mile in length, is marked by a white 20 cylindrical buoy at its southern and northern ends; a third white cylindrical buoy marks the limit of the surveyed area, northward of the channel.

The eastern channel is marked by 3 red can buoys, and a red cylindrical buoy marks its northern end. Two beacons mark the edges of 25 the banks of a creek entrance about $1\frac{1}{2}$ miles northward of the eastern channel entrance; another beacon marks the eastern side of this channel about $1\frac{3}{4}$ miles northward.

Anchorage.—Anchorage may be obtained by vessels with local knowledge off Maungdaw (*Lat.* $20^\circ 50' N.$, *Long.* $92^\circ 21' E.$), in a depth 30 of about $4\frac{1}{2}$ fathoms (8^m2).

Communication.—From the end of November to the end of April there is regular sea communication with Akyab and Chittagong; steam launches communicate with Tumbru at the head of Nāf river, during the South-west monsoon. A light railway connects Maungdaw with 35 Buthidaung, about 20 miles east-north-eastward, whence there is communication by launch with Rathedaung and Akyab all the year round.

Cypress point to Foul point.—Coast.—From Cypress point the coast trends south-eastward for about 34 miles to Foul point, the 40 northern entrance point of Mayu river. About $12\frac{1}{2}$ miles south-eastward of Cypress point is a point close within which is Sitaparokia, a small conical hill, 224 feet (68^m3) high, with the ruins of a temple on its summit. A prominent rock, 20 feet (6^m1) high and shaped like a chair, lies about one cable offshore about half a mile north-north- 45 westward of Sitaparokia.

Chart 3508.

Between Sitaparokia and Foul point the coast is backed by the Mayu range which, with many sharp peaks, gradually approaches the coast from a distance of about 4 miles inland abreast Sitaparokia, to 50 less than one mile abreast Fakirmura; this latter hill, 435 feet (132^m6) high, and easily identified, is situated about 3 miles north-westward of Foul point at the southern end of Mayu range. Mount Todd, 1,109 feet (338^m0) high, situated about $4\frac{1}{4}$ miles north-north-westward of Fakirmura, appears flat-topped and slightly higher than the peaks on either

Chart 3508.

side when seen from westward, but, viewed from southward, presents a prominent sharp peak.

The Ugidaung (Agandu) ridge, which attains an elevation of 631 feet (192^m3) about 7 miles east-north-eastward of Fakirmura, is flat-topped 5 and crowned by a pagoda.

Chart 821.

Bengaya (Bengara), a prominent peak 1,356 feet (413^m3) high, is situated about 19 miles north-eastward of Fakirmura and is easily identified when open southward of the latter hill. 10

Chart 3493.

Off-lying islands and dangers.—Light.—Buoy.—St. Martin's islands and St. Martin's reef are described on page 265.

North Delay shoal is a small patch of hard ground, with a least depth of 4 fathoms (7^m3) over it, situated about 6½ miles south-westward of the southern point of St. Martin's islands. 16

South Delay shoal (*Lat.* 20° 28' N., *Long.* 92° 16' E.) is a ridge, with very irregular depths over it, situated about 2 miles southward of North Delay shoal. The least depth over it that was obtained was 5½ fathoms (9^m6), but, as pinnacles with less depths may exist, 20 it should not be crossed.

Sitaparokia patches are a number of shoals, with depths of less than 5 fathoms (9^m1) over them, situated about 6 miles westward of Sitaparokia; the shoal with the least depth over it, which is 1½ fathoms (2^m7), is situated near the northern end of the patches. 25 There are depths of from 5½ to 7 fathoms (10^m1 to 12^m8) between the patches and St. Martin's islands, and depths of from 4½ to 5 fathoms (8^m2 to 9^m1) between them and the mainland.

Asirgarh shoal, a small rocky shoal with a depth of less than 6 feet (1^m8) over it, lies about 6½ miles south-westward of Sitaparokia: 30 it breaks at low water and in heavy weather. A shoal, with a depth of 5½ fathoms (9^m6) over it, lies about 1½ miles north-westward of Asirgarh shoal.

A 1½-fathom (3^m2) rocky patch lies about 2 miles southward of Sitaparokia and about 1½ miles offshore. 35

Charts 3493, 1369.

Oyster island, situated about 12¾ miles west-south-westward of Foul point, is low and sandy and, with the exception of a few coconut palms, is devoid of vegetation; its eastern and western coasts are protected from erosion by a low sea-wall of boulders. The island lies on a ledge 40 of rocks from which depths of less than 5 fathoms (9^m1) extend about 1½ miles north-north-westward and about 3½ miles south-eastward.

A light is exhibited, at an elevation of 130 feet (39^m6), from an iron tower, painted in black and white horizontal bands and with a white dome, 141 feet (43^m0) in height, situated near the middle of the north-eastern side of Oyster island. A flagstaff, some buildings and some 45 low trees, stand near the lighthouse.



Oyster island from eastward.

(Original dated prior to 1910.)

Charts 821, 829, 70.

Charts 3493, 1369.

An iron pier with a wooden deck about 350 feet (106^m7) long and 12 feet (3^m7) wide, used for servicing the lighthouse, is situated on the north-eastern side of the island. Landing may possibly be also effected on a small sandy beach some distance southward of the pier, but during the South-west monsoon a heavy swell makes any landing difficult and dangerous. Water is not obtainable on the island.

Chart 3493.

Taylor shoal, situated about 8 miles west-north-westward of Oyster Island lighthouse, has a least known depth of 4½ fathoms (7^m8), but as the depths over this shoal are very irregular, there may be less depths on it than charted and vessels should avoid passing over any part of it.

Chart 1369.

Oyster reef, a dangerous reef with a least depth of 1½ fathoms (2^m3), is situated between 8 and 10 miles south-eastward of Oyster Island lighthouse (*Lat.* 20° 12' N., *Long.* 92° 32' E.). The sea always breaks on the reef in bad weather or if there is any swell. It is covered by a red sector of Oyster Island light between the bearings of 310° and 325°.

A red can buoy, surmounted by a staff and cage, is moored about 1½ miles southward of the reef and about 12 miles south-eastward of Oyster Island lighthouse. The buoy is withdrawn annually from 1st May to 1st November.

There is a channel with depths of from 5½ to 8 fathoms (10^m5 to 14^m6), between the northern end of Oyster reef and the foul ground extending south-eastward from Oyster island.

Heckford patch, situated about 9 miles south-south-eastward of Oyster reef, is described on page 270.

Chart 3508.

Mayu river.—Mayu river is entered between Foul point and Mayu point, about 3½ miles southward. The river, which flows almost due south; has been surveyed for a distance of about 12 miles above the entrance. Kazidiya kyun (Pawkyun Thi), an island with a shoal extending southward from it, divides the river into two channels for about 8 or 9 miles close within the entrance.

About 3 miles northward of Mayu point, Mayu river is joined by Kywede (Kywide) river which flows in from eastward. This latter river has been surveyed for a distance of about 4 miles. Rathedaung town is situated on the northern bank of Rathedaung creek, which enters Mayu river through the eastern bank, about 12 miles above Foul point. There is communication between Rathedaung and Akyab by steam launches.

Dangers in the entrance.—Bar.—Depths.—The coast between Foul point and a position abreast Mount Todd, about 8 miles north-westward, is fronted by a bank which, with depths of less than 3 fathoms (5^m5) extends as much as 7½ miles south-south-westward of Foul point where it terminates in North spit. On the inner part of this bank are two detached islets, the eastern extremity of the south-eastern one lying about 1½ miles southward of Foul point; there are numerous rocks and patches which dry from 2 to 8 feet (0^m6 to 2^m4), lying between the south-western islet and Foul point, but the eastern edge of this foul ground is moderately steep-to. Burne rocks, one of which is 3 feet (0^m9) high, lie about 3 cables south-eastward of the south-eastern islet and dry from one to 4 feet (0^m3 to 1^m2) in places.

Charts 821, 829, 70.

Chart 3508.

Martini sands, which extend for about 2 miles southward from Burne rocks, are constantly changing and, inside the breakers, are awash at low water.

A bank on which the depths are less than 3 fathoms (5^m5) fronts 5 Mayu point and the coast south-eastward of it, extending as much as 4½ miles south-south-westward of Mayu point and terminating in South spit. Mayu spit, which extends for about 2 miles from Mayu point along the north-western edge of this bank, is awash at low water.

The bar, over which there is a least depth of 19 feet (5^m8), lies 10 between the outer ends of North and South spits. At about half a mile within the bar, the depths increase to 5 fathoms (9^m1), and to about 13 fathoms (23^m8) westward of Mayu point, shoaling again to from 5 to 6 fathoms (9^m1 to 11^m0), eastward of Foul point.

Mayu river above the entrance.—The channel eastward of 15 Kazidiya kyun (*Lat.* 20° 24' N., *Long.* 92° 45' E.) and the shoal extending southward from it, has a least depth of 18 feet (5^m5) and, although much obstructed by fishing stakes, is the easier channel to navigate. The channel westward of the island and shoal, has a least depth of 19 feet (5^m8) in the fairway, but its southern entrance is narrow and 20 dangerous.

There are depths of from 5 to 7 fathoms (9^m1 to 12^m8) in the fairway of Kywede river for about 4 miles above its junction with Mayu river.

Caution.—In 1945, it was reported that considerable shoaling had occurred in the eastern channel of Mayu river north-eastward of Foul 25 point, and also at the junction of Mayu and Kywede rivers.

Tidal streams.—The tidal streams at the bar have a rate of about 2½ knots at springs and 1½ knots at neaps, setting north-north-east on the rising tide and south-south-west on the falling tide. In the river the streams attain a rate of 3½ knots at springs. 30

Anchorage.—**Directions.**—Good anchorage may be obtained eastward of Burne rocks, in depths of from 6 to 9 fathoms (11^m0 to 16^m5); just southward of Nganabya creek, about 1½ miles northward of Kazidiya kyun, and nearly a quarter of a mile off the eastern bank, in a depth of 5 fathoms (9^m1); or about the same distance off the 35 western bank, opposite Rathedaung, in a depth of 4 fathoms (7^m3).

Vessels should cross the bar between North and South spits with a wooden pagoda, in line with a distant bluff, bearing 001°; the pagoda is situated at an elevation of 271 feet (82^m6), about 2¾ miles north-north-westward of Foul point, and stands on the eastern edge of a clump 40 of trees; it is difficult to distinguish. See view A on chart 3508. When Pimple hill, 354 feet (107^m9) high, situated about 6½ miles north-eastward of Foul point, bears 032° and is in line with Bengaya (Chart 821), see view B on chart 3508, course should be shaped to keep it on that bearing until Mayu point bears 158° when course should be 45 altered to pass about half a mile eastward of Burne rocks.

Charts 1885, 1369.

AKYAB AND APPROACHES.—**Light.**—Kaladan river is entered between Fakir point, situated about 10 miles south-eastward of Mayu point, and Hodge point, the north-western point of Myengun 50 kyun, about 2½ miles south-south-eastward. The town of Akyab is situated on the right bank of Kaladan river between one and 3 miles northward of Fakir point.

Charts 821, 829, 70.

Charts 1885, 1369.

Savage Island light is exhibited, at an elevation of 110 feet (33^m5), from a white, circular stone tower, 70 feet (21^m3) in height, with a red lantern and white dome, situated on the north-western point of Savage island, an islet on the southern side of the entrance, about 1½ miles southward of Fakir point.

Chart 1369.

Off-lying danger.—Heckford patch, a rocky shoal with a least depth of 5½ fathoms (9^m6), is situated about 14 miles south-westward of 10 Fakir point; as the depths are irregular in the vicinity of this shoal, vessels should not attempt to cross it.

Charts 1885, 1884.

Outer bar.—**Buoy.**—An extensive flat known as Horse Shoe shoal, with depths of less than 3 fathoms (5^m5) over it, extends about 4 miles 15 south-south-westward from the coast north-westward of Fakir point, and then extends in a prong eastward; in 1945, the eastern extremity of this prong lay about 3½ miles southward of Fakir point (*Lat.* 20° 07' N., *Long.* 92° 54' E.).

Chart 1885.

20 The outer bar, which lies between the eastern extremity of the prong and the western coast of Myengun kyun, had in 1945, a least depth of 25 feet (7^m6) in the fairway of the entrance channel; within the bar, the depths increase.

A black can buoy is moored about three-quarters of a mile south- 25 south-eastward of the eastern end of the prong of Horse Shoe shoal, and about 2½ miles south-south-westward of Hodge point; the buoy is liable to be washed away.

Entrance. — Rocks and dangers. — Light-buoy. — Beacon. — Fakir point, the northern entrance point, is low and backed by low 30 ground covered with coconut palms; a prominent tower and a signal station stand on the point.

Fakir reef, on which are some rocks which dry 3 feet (0^m9), lies about 4½ cables south-south-eastward of Fakir point; a light-buoy, painted black and exhibiting a *white flashing light every second*, is moored 35 about 2 cables south-eastward of Fakir reef and about 6½ cables south-south-eastward of Fakir point. In 1945, that part of Horse Shoe shoal lying south-westward of Fakir reef, was extending eastward.

Passage rock, on the southern side of the entrance about 1½ miles southward of Fakir point, is 14 feet (4^m3) high. Savage Island, 65 feet 40 (19^m8) high, lies about a quarter of a mile south-eastward of Passage rock. Savage island light is described above.

The only off-lying dangers on the south-eastern side of the entrance are:—A rock with a depth of 28 feet (8^m5) over it and 32 feet (9^m8) close north-westward of it, lying about one cable northward of Passage 45 rock; a rock with a depth of 19 feet (5^m8) over it, about 3¾ cables east-north-eastward of Passage rock; and a shoal with a least depth of 6 feet (1^m8) over it, lying about 5½ cables north-eastward of Savage island.

Peaked rocks, the largest of which is 10 feet (3^m0) high, lie about 50 3¼ cables south-westward of Savage island. White rocks, 22 feet (6^m7) high, lie between 4 cables southward, and one mile south-south-eastward of Savage island; between White rocks and Hodge point are drying mud flats.

A beacon, consisting of a concrete pillar surmounted by a cage, the

Charts 1369, 821, 829, 70.

Chart 1885.

top of which has an elevation of 37 feet (11^m3), stands on White rocks, about 5½ cables southward of Savage Island lighthouse.

Kaladan river above the entrance.—Dangers.—Buoyage.—Saunders shoal, with a least depth of 16 feet (4^m9) over it, lies nearly 5 in mid-river, extending about three-quarters of a mile east-north-eastward from a position about 1½ miles eastward of Fakir point. A can light-buoy, painted black and exhibiting a *white flashing* light every two-and-a-half seconds, is moored about one cable south-westward of the south-western end of Saunders shoal, and a red conical buoy 10 is moored about 1½ cables east-north-eastward of a detached 18-foot (6^m5) patch which forms the north-eastern end of the shoal.

Ngapi kyun, a low island covered with brushwood, occupies the centre of Kaladan river about 5½ miles north-eastward of Fakir point. Flat island spit, an extensive mud spit which dries in places, fronts the 15 southern side of Ngapi kyun and extends about 3½ miles south-westward; it lies on a bank which, with depths of less than 3 fathoms (5^m5), extends to a position about one mile north-eastward of Fakir point (*Lat. 20° 07' N., Long. 92° 54' E.*).

Lower Spit can light-buoy, painted black and exhibiting a *white* 20 *flashing* light every one-and-a-half seconds, is moored close southward of the south-western extremity of the bank surrounding Flat Island spit.

Western branch of Kaladan river.—Inner bar.—Buoys.—The western branch of Kaladan river lies between Ngapi kyun and the 25 western edge of the bank surrounding Flat Island spit on the east, and the coast of the mainland forming the right bank of the river, on the west. It is entered across the inner bar.

The inner bar, which lies between the coast of the mainland about one mile northward of Fakir point, and the south-western extremity of 30 the bank surrounding Flat Island spit, had in 1945, a least depth of 18 feet (5^m5); it leads to the main wharf at Akyab, about 1½ miles northward of Fakir point, and to a channel formed by the western branch of the river in which there are depths of from 19 to 23 feet (5^m8 to 7^m0) abreast the water front of Akyab town, and from 24 to 35 30 feet (7^m3 to 9^m1) at an anchorage farther north-north-eastward.

Two red conical buoys are moored about 2½ and 3½ miles, respectively, north-north-eastward of Akyab main wharf, and mark the eastern side of the fairway of the western branch of the river.

The entrances to Satyogya chaung, known locally as Cheruga creek, 40 a creek on the northern side of the town of Akyab, about 1½ miles north-eastward of the main wharf, and Mangan chaung, about 2½ miles farther north-north-eastward, are marked by buoys. An overhead cable suspended between 2 masts with a clearance of 80 feet (24^m4), crosses Mangan chaung about 1½ miles above its mouth. 45

The passage up the western branch of the river and through a narrow and shallow channel between the northern side of Ngapi kyun and Paw kyun, a low island close northward, which is covered with brushwood, is marked by buoys.

There are a number of fixed moorings and mooring buoys between 50 Akyab main wharf and a position about three-quarters of a mile north-north-eastward of the entrance to Satyogya chaung, the positions of which can best be seen on the chart.

Eastern branch of Kaladan river.—Buoys.—Danger.—Two

Charts 1884, 1369, 821, 829, 70.

Chart 1885.

black can buoys, moored about $2\frac{1}{2}$ and 4 miles, respectively, north-eastward of Fakir point, mark the south-eastern edge of the bank surrounding Flat Island spit.

- 5 Kywegu river flows into the eastern branch of Kaladan river about 5 miles north-eastward of Hodge point ; Walkan island, on which is Tumble Down Dick rock, a prominent peak, 199 feet (60^m7) high, lies in the mouth of Kywegu river close northward of its southern entrance point.
- 10 Cursetjee shoal, on which there is a least depth of 15 feet (4^m6), lies near the middle of the eastern branch of Kaladan river, from $1\frac{1}{2}$ to $1\frac{3}{4}$ miles northward of Tumble Down Dick rock. A shoal with a least depth of 18 feet (5^m5) lies about $6\frac{1}{2}$ cables northward of the northern extremity of Cursetjee shoal ; there are depths of from 19 to 21 feet
- 15 (5^m8 to 6^m4), between these two shoals.

Pilots.—Pilots licensed by the Government of Burma are stationed at Fakir point, on which is a lookout station, and, on a vessel being sighted in the offing, a pilot proceeds out to her in a white motor-boat.

- In the event of no pilot being available, vessels should anchor about 20 one mile southward of the outer bar buoy until one can be obtained.

Tides.—**Tidal streams.**—The tides rise and fall quickly, the slack water lasting about one hour during springs and from 2 to 3 hours at neaps.

- During the South-west monsoon season, June to October, the mean 25 level of the river rises about 2 feet (0^m6).

- The tidal streams are regular, and rapid at springs, when heavy overfalls form on the ebb stream between Fakir reef and Passage rock. The rate at springs on the outer bar is from three-quarters of a knot to 2 knots, but between Fakir point and Passage rock they 30 attain a rate of from 3 to 4 knots, and during the South-west monsoon as much as 7 knots ; during neaps the streams are very weak.

The streams set directly across Fakir reef, and a vessel leaving the anchorage when the ebb stream is running will be set towards that reef after passing Fakir point (*Lat.* $20^\circ 07' N.$, *Long.* $92^\circ 54' E.$).

- 35 *Chart 1884.*

Anchorage.—Temporary anchorage may be obtained outside the outer bar, in depths of from 7 to 8 fathoms (12^m8 to 14^m6), with Savage Island lighthouse bearing 000° and Laule taung, situated on Myengun kyun, about $3\frac{3}{4}$ miles south-eastward of Hodge point, bearing 090° .

- 40 This anchorage is not always practicable during the South-west monsoon.

Chart 1885.

- Merchant vessels usually anchor in the western branch of the river, close offshore between Akyab main wharf and the entrance to Satyogya 45 chaung, to facilitate working cargo, but if this is not required, a convenient anchorage for vessels of less than 18 feet (5^m5) draught, is off the hospital, about a quarter of a mile southward of the main wharf ; in 1945, this area was being dredged to a depth of 21 feet (6^m4). When necessary, vessels use an anchorage below the inner bar to complete 50 loading ; a good berth for this purpose is between Saunders shoal and Lower Spit light-buoy, in depths of 24 feet (7^m3). Men-of-war are recommended to anchor off the entrance to Satyogya chaung ; at the entrance to this creek is a good landing place which can be used by boats at any stage of tide.

Charts 1884, 1369, 821, 829, 70.

Chart 1885.

When anchored anywhere inside Fakir point vessels are very liable to drag their anchors during spring tides which here run with considerable velocity. At least 8 shackles of cable should be veered when anchored anywhere in the vicinity. 5

As silting is liable to take place, it is advisable to obtain local information before anchoring.

Prohibited anchorage.—On account of a pipe line, anchorage is prohibited about one mile north-north-eastward of the main wharf in an area indicated by pecked lines on the chart. 10

Charts 1884, 1885.

Directions.—Caution.—Vessels entering harbour with the flood stream must exercise great care when in the vicinity of White rocks as this stream sets directly on to them ; vessels leaving harbour with the ebb stream should keep as close to these rocks as is prudent, to prevent 15 being set on to Horse Shoe shoal.

Vessels are prohibited from entering or leaving the port between sunset and sunrise.

During the South-west monsoon, deep-draught vessels from westward should approach keeping Laule taung bearing 091° , which leads 20 between Oyster reef and Heckford patch. When White rocks beacon bears 350° and is in line with Savage Island lighthouse, it should be steered for on that bearing, which leads over the outer bar in a least depth of 25 feet (7^m6). During the South-west monsoon, vessels should have a clearance of from 3 to 4 feet (0^m9 to 1^m2) under them on 25 account of the swell.

Chart 1885.

When about $1\frac{1}{2}$ miles distant from White rocks beacon, course should be altered westward to make good a course of 330° , passing about 4 cables west-south-westward of the beacon ; when Savage Island light- 30 house bears 090° , course should be altered eastward to pass about $2\frac{1}{2}$ cables north-westward of Passage rock and thence about $3\frac{1}{2}$ cables south-eastward of Fakir point light-buoy. When Fakir point bears 315° , course may be shaped to pass between the point and Saunders shoal for the anchorage, or for the inner bar, bearing in mind that 35 during the ebb, there is a strong set southward and westward, and that vessels entering should therefore keep well up-river after passing Fakir reef light-buoy before turning towards the anchorage.

Boats and small craft with local knowledge can make use of a safe passage between Savage island and the northern end of Myengun 40 kyun, which affords shelter from the swell during the South-west monsoon.

Wharf and jetties.—Main wharf (*Lat. $20^{\circ} 08' N.$, Long. $92^{\circ} 54' E.$*), an iron pier with a wooden deck, extends from the waterfront of Akyab, about $1\frac{1}{2}$ miles northward of Fakir point ; its T-head is 324 feet (98^m8) 45 in length. A stone pier extends from the river bank about 3 cables southward of Main wharf. In 1945, an area about one cable in width, extending from northward of the wharf to southward of the stone pier, and which is indicated on the chart by pecked lines, was being dredged to a depth of 21 feet (6^m4). In 1953, it was reported that there was 50 a depth of 27 feet (8^m2) alongside the head of Main wharf and that work was in progress facing the head with wooden fenders so that vessels could berth alongside.

There is a seaplane base with a jetty situated about 3 cables

Charts 1369, 821, 829, 70.

Chart 1885.

northward of Fakir point ; it was reported in 1953 that the head of the jetty dried at low water. On either side of the entrance to Satyogya chaung are the remains of a number of small wooden jetties and the southern bank of this creek is lined with wharves.

Town.—Akyab town, the headquarters of Akyab district, is situated on a well wooded, low island, separated from the mainland by Satyogya chaung which connects the Kaladan and Mayu rivers.

The houses of the Europeans are situated near the point and along the shore of the harbour, the northern part of the town being the native town.

The population in 1931 was 38,094.

The town is unhealthy, being subject to occasional epidemics of cholera, and malarial fever is endemic. During the South-west monsoon the rainfall is very heavy, the whole country becoming almost inundated, and the rivers swollen ; the winter months are very dry.

Port facilities.—The port suffered extensive damage during the recent hostilities. Repair work was put in hand in 1945 when the port was recaptured from the Japanese.

A moderate supply of coal is normally maintained.

Water can be supplied, afloat, by water boats at a rate of from 2,000 to 4,000 gallons per hour, or alongside Main wharf.

Fresh provisions are always available, but vegetables are scarce.

Repairs to vessels can be undertaken ; there are several cranes with lifting capacities of from 3 to 7 tons.

There is a patent slip at Akyab. For dimensions, *see* Appendix I.

There is a large general hospital in the town.

The principal exports are rice, salt, bran and paddy and the chief imports, cloth, gunny bags, dried fish and cotton.

There is regular sea communication with Calcutta.

There is regular air communication with Calcutta and Rangoon.

There is a system of inland water communication throughout the district.

Quarantine.—There are special quarantine regulations at Akyab, a copy of which should be obtained from the Port Officer.

Climatic table.—*See* page 79.

Storm and weather signals.—The extended system, *see* pages 30-34 is in use at Akyab (*Lat.* 20° 08' N., *Long.* 92° 54' E.).

Winds and weather.—The South-west monsoon begins early in May, and lasts until the end of October. Occasionally the South-west monsoon increases in strength from a southerly direction, and is accompanied by heavy rain and sea, when caution is necessary in approaching the land.

During the North-east monsoon the wind commences at north in the morning, and gradually alters its direction to the south-east towards noon ; it is then calm until the sea breeze sets in from between west and south-west, which veers to north-west in the evening. These winds prevail with regularity from November to March. Thick fog may be expected during the winter months with the in-going tidal stream.

Charts 1884, 1369.

MYENGUN KYUN TO KYAUKPYU HARBOUR.—**Coast.**—

Rocks and dangers.—Myengun kyun, about 17½ miles long in a south-south-easterly direction between Hodge point and Boronga

Charts 821, 829, 70.

Charts 1884, 1369.

point, its southern extremity, is mostly high and densely wooded. Laule taung or Beacon hill is a plateau, 962 feet (293^m2) high, and is a good mark except from south-south-eastward, from which direction it is hidden by a mountain, 1,135 feet (345^m9) high, about 6½ miles distant from it; this latter mountain appears as a sharp peak when seen from southward, but from westward presents a jagged ridge, no point of which is conspicuous.

Chart 1369.

South hummock, a hill about one mile northward of Boronga point, is prominent when seen from westward as also is a white pagoda which stands on the western coast on a low hill, about 2½ miles northward of South hummock.

A narrow ledge of rocks, most of which cover at high water, extends about 6 cables southward from Boronga point; South rock, awash at high water, lies at the southern end of this ledge, and other rocks, which dry, extend for about 2 cables southward of South rock; beyond them, foul ground extends about half a mile farther southward.

Peinnechaung kyun, a high and thickly wooded island, lies between 3 and 6 miles eastward of Myengun kyun and roughly parallel with it, being separated from the latter island by Research strait. The strait has considerable depths at its southern end but is blocked by shoals at its northern end where it joins Kaladan river. It affords a sheltered passage for boats and small craft with local knowledge which is invaluable during the South-west monsoon.

A chain of small islands and rocks lies on a narrow ridge extending about 6 miles south-south-eastward from the southern point of Peinnechaung kyun, which is situated about 8 miles eastward of Boronga point. The principal marks in the chain, starting from northward, are: Kyauktwe (Square rock) (Lat. 19° 46' N., Long. 93° 11' E.), 33 feet (10^m1) high; Painaisa island, 190 feet (57^m9) high; Barn island, 100 feet (30^m5) high and reddish-coloured; Conspicuous rock, 30 feet (9^m1) high; and South rocks, 12 feet (3^m7) high, white and flat. Of these, Conspicuous rock and Painaisa island are easily identified. About 2 miles south-eastward of South rocks and one mile from the extremity of the ridge, is Bingham rock, which dries 3 feet (0^m9), with depths of 11 to 12 fathoms (20^m1 to 21^m9) between it and the ridge.

Ingrinchaing kyun, which lies about 3½ miles eastward of the eastern side of Peinnechaung kyun, and runs roughly parallel with it, is inconspicuous from seaward. Detached rocks and shoals, the outermost of which dries 8 feet (2^m4), extend about 5 miles south-eastward from its southern point.

Off-lying dangers.—Caution.—Mud volcanoes (*see* page 43), which occur in the sea off this coast, frequently raise islets which may remain above water for some time, or quickly sink, leaving dangerous shoals in their places; a constant and careful lookout is consequently necessary when navigating in this locality.

In 1917, a patch of muddy water was reported in a position about 7½ miles west-south-westward of Boronga point.

In 1924, an area of shoal water was reported in a position about 8 miles southward of Boronga point, around the former position of a mud volcano and for a distance of about 2½ miles westward of it; the south-eastern corner of this shoal was marked by breakers. In 1935, shoal depths and breakers were again reported in this vicinity.

Charts 821, 829, 70.

Chart 1369.

A mud volcano shoal with a depth of $3\frac{1}{4}$ fathoms (5^m9) over it and depths of 15 fathoms (27^m4) around it, is situated in the entrance to Research strait, about $2\frac{1}{4}$ miles eastward of South hummock. This shoal was formed by the action, probably intermittent, of an active mud volcano.

Hunter bay.—Hunter bay is entered between the southern extremity of Ingrinchaing kyun and the north-western point of Kyunthaya, an island situated about 10 miles east-south-eastward. The latter island is bold, reaching an elevation of 860 feet (262^m1) but has no well-defined summit; the northern, which is the highest part of the island, is the most conspicuous.

About $4\frac{1}{4}$ miles north-eastward of the north-western point of Kyunthaya, is Retkamauk taung, a conspicuous mountain, 1,576 feet (480^m4) high, which stands near the south-western side of a large unnamed island which forms the major part of the eastern side of Hunter bay.

Hunter bay is very shallow with narrow channels indicating the entrances to small rivers or creeks. The small vessels which afford inter-communication by the inshore channels, usually pass through Myebon river which flows into the north-eastern corner of the bay, about 16 miles northward of the north-western point of Kyunthaya, and call at Myebon (*Lat. $20^\circ 03' N.$, Long. $93^\circ 23' E.$*), a town of some importance situated on the western bank of the river about $1\frac{1}{2}$ miles above the mouth. There is a navigable channel on the western side of Hunter bay off the eastern coast of Ingrinchaing kyun, which is used by vessels plying between Akyab and Kyaukpyu, *see* below, and small craft also ply in several of the numerous creeks eastward of Hunter and Combermere bays.

30 Combermere bay.—Caution.—Anchorage.—Combermere bay is entered between the south-western side of Kyunthaya and the northern point of Nakhaungbauk kyun, about $6\frac{1}{2}$ miles southward. The navigation of the bay, for which the chart is the only guide, is intricate and dangerous, and the bay is rarely entered by European vessels.

Nasapo kyun, about $2\frac{1}{4}$ miles east-south-eastward of Kyunthaya, is 365 feet (111^m2) high, wedge-shaped and a prominent mark. Naungdaw kyun, about one mile eastward of Nasapo kyun, attains an elevation of 840 feet (256^m0) in Seppings (Seppinas) peak, a prominent conical summit near its north-western side, which slopes gradually south-eastward to the coast.

Combermere bay is an extensive inlet into which flow many small creeks and rivers. The most important of these is An chaung which flows into the south-eastern corner of the head of the bay and which is navigable by boats as far as the town of An (chart 821), situated on the eastern bank of the river about 32 miles above the mouth.

Temporary open anchorage may be obtained off the entrance to Combermere bay, in depths of from 7 to 9 fathoms (12^m8 to 16^m5), mud and good holding ground.

50 Chart 831, plan of Kyaukpyu harbour.

KYAUKPYU HARBOUR AND APPROACHES.—Caution.—Kyaukpyu harbour is situated on the southern side of Combermere bay, from which it is separated by Tankharo island which lies about

Charts 1369, 821, 829, 70.

Chart 831, plan of Kyaukpyu harbour.

1½ miles south-eastward of Nakhaungbauk kyun. The town of Kyaukpyu stands on the southern shore of the harbour about 5½ miles within the entrance. The name Kyaukpyu means "White shore" and is probably derived from a white pebbly beach in front of the town. 5

The harbour is entered between Myethpyn (Myethpyu) kyun, about three-quarters of a mile south-westward of the southern end of Nakhaungbauk kyun (chart 1369), and Saddle island, known to the Burmese as Pyu kyun, about 6½ miles south-south-westward and is only exposed west-north-westward; it affords well-sheltered anchorage in depths of from 9 to 10 fathoms (16^m5 to 18^m3). 10

At its eastern end, Kyaukpyu harbour leads into Fletcher Hayes strait, between the north-eastern side of Ramree island and the mainland; this channel forms a broad, safe and convenient boat passage which communicates through Mingaung chaung (chart 821), a small creek, with Ramree harbour, *see* page 288, about 32 miles south-eastward of Kyaukpyu town. 15

The positions of the buoys marking shoals in the harbour, are not to be relied upon. 20

Chart 831.

Dangers in the approach.—The Terribles consist of three groups of rocks situated on the southern side of the western approach to Kyaukpyu harbour; they lie between 8 miles west-north-westward, and 10½ miles west-south-westward of Saddle island (*Lat.* 19° 26' N., *Long.* 93° 27' E.). 25

North Terrible, the northernmost above-water rock of the groups, is 12 feet (3^m7) high; rocks which dry lie within 1½ miles northward of it. Middle Terrible, 14 feet (4^m3) high, lies about 1½ miles south-westward of North Terrible. Rocks which dry 4 feet (1^m2), lie about 1½ miles west-north-westward, and about one mile south-south-westward, respectively, of Middle Terrible. South Terrible, about 3 miles south-south-westward of Middle Terrible, consists of several low rocks the highest being 12 feet (3^m7) high; breakers extend about 1½ miles south-south-eastward from it, South rock, which dries 6 feet (1^m8), being near their southern extremity. 35

In 1952, a volcanic eruption was reported to have occurred in a position about 3 miles north-north-westward of North Terrible.

Unless bound for Kyaukpyu harbour or Cheduba strait, *see* page 282, vessels should not approach within depths of 20 fathoms (36^m6) southward, or 24 fathoms (43^m9) westward of the Terribles, and a wide berth should be given them at night. 40

During the survey in 1908, a shoal formed by an active mud volcano, with a least depth of 4½ fathoms (7^m8) over it, was found about 3 miles west-south-westward of Middle Terrible. Its position when close-to was marked by discoloured water, but as the shoal area may have increased, or other shoals may have been formed, this locality should be avoided, *see* page 43. 45

Irrawaddy rock which dries 2 feet (0^m6), lies at the south-western end of a shoal with depths of less than 5 fathoms (9^m1), situated about 5 miles eastward of Middle Terrible; the rock is not easily distinguished in a smooth sea. A shoal over which the sea breaks, lies about 6½ cables eastward of Irrawaddy rock. There are depths of from 8 to 11 fathoms (14^m6 to 20^m1) in the fairway of Dickenson 50

Charts 1369, 821, 829, 70.

Chart 831.

channel, the passage between Irrawaddy rock and the foul ground extending westward from Saddle island, *see* page 279.

In 1909, a volcanic upheaval was reported to have occurred in the southern approach to Dickenson channel, about $3\frac{1}{2}$ miles southward of Irrawaddy rock, and in 1931, a mud volcano was sighted in this position by S.S. *Egra*.

Chart 831, with plan of Kyaukpyu harbour.

Northern side of Kyaukpyu harbour.—Islands and dangers.—

10 **Buoys.—Light.**—Myethpyn kyun is the westernmost of the group of islands on the northern side of Kyaukpyu harbour. It is composed of reddish earth and is sparsely wooded, but from seaward blends with the high wooded peaks of the islands behind it and is not conspicuous.

A reef surrounds Myethpyn kyun, extending about $1\frac{1}{2}$ cables from its north-eastern and south-western points, and foul ground, with rocks from 3 to 5 feet (0^m9 to 1^m5) high, extends as much as 2 miles north-north-westward from the island; as the locality has not been closely examined, vessels should keep outside a distance of 3 miles north-westward of the island.

20 *Chart 831, plan of Kyaukpyu harbour.*

Kyu kyun lies about three-quarters of a mile eastward of Myethpyn kyun.

Tankharo island, long, narrow and thickly wooded, lies between Catherine bluff, its north-westward extremity, situated about 6 cables south-south-eastward of Kyu kyun, and Barker point, its south-eastern end, about $6\frac{1}{4}$ miles south-eastward. Wood harbour, the entrance to which lies between Kyu kyun and Catherine bluff, is described on page 279.

Kyaukpandu (*Lat.* $19^\circ 29' N.$, *Long.* $93^\circ 30' E.$), 85 feet (25^m9) high, lies about $2\frac{1}{4}$ miles south-south-westward of Catherine bluff; it is of conical form with two sharp-pointed peaks close together. The rock is steep-to on its western and southern sides but depths of less than 3 fathoms (5^m5) commence about half a cable eastward of it. Its seaward side is occasionally whitewashed, and then makes an excellent mark. The edible nest of the swift is found here.

Giles bank, with depths of $3\frac{3}{4}$ and $4\frac{3}{4}$ fathoms (6^m9 and 8^m7), respectively, over its northern and southern ends, lies about $2\frac{3}{4}$ miles west-south-westward of Kyaukpandu. A can buoy is moored about $2\frac{1}{2}$ cables south-westward of the southern end of Giles bank.

40 A bank with a least depth of $4\frac{1}{4}$ fathoms (7^m8) over it, lies about one mile south-westward of Kyaukpandu, and about midway between this bank and Giles bank there are depths of from $5\frac{1}{4}$ to $6\frac{1}{4}$ fathoms (9^m6 to 11^m4).

Sinbaikchaing is a low island situated between Kyaukpandu and Tankharo island. A wooded ridge about 60 feet (18^m3) high extends about $6\frac{1}{2}$ cables south-eastward from the middle of the western side of the island; there is a small pagoda on the northern end of this ridge. The eastern and southern parts of the island are low and swampy. Its western side is fringed with reefs and detached rocks, and depths of less than 3 fathoms (5^m5) extend about $1\frac{1}{2}$ miles westward from it. Foul ground extends about $6\frac{1}{2}$ cables north-westward of the north-western point of the island, and a rock, 4 feet (1^m2) high and breakers, are situated near the extremity of this foul ground.

Squadron rocks, which are low with a few shrubs and a solitary tree

Chart 831, plan of Kyaukpyu harbour.

on them, lie about $1\frac{1}{2}$ cables westward of the southern point of Sinbaikchaing; the southernmost rock is 15 feet (4^m6) high, and a rock awash, lies about 3 cables south-south-eastward of it.

North shoal, a small rocky patch, the northern part of which dries 2 feet (0^m6) while the south-eastern part has a least depth of $2\frac{1}{2}$ fathoms (4^m6), lies about three-quarters of a mile west-south-westward of the southernmost of Squadron rocks. A can buoy is moored close south-westward of North shoal.

Ledaung kyun, which is thickly wooded, lies close south-eastward of Sinbaikchaing and from seaward appears wedge-shaped, the north-western part being the higher. See view on chart 831, plan of Kyaukpyu harbour. The area between two prongs, which form the south-eastern part of the island, dries about 5 feet (1^m5), and the area between the southern prong, which is also the southern extremity of Ledaung kyun, and Barker point, about $3\frac{3}{4}$ miles eastward, is filled by a shallow flat, on the outer part of which the depths are less than 3 fathoms (5^m5) and less than 6 feet (1^m8) on the inner part; a detached $1\frac{1}{4}$ -fathom (2^m3) patch lies close southward of this flat, about $5\frac{1}{2}$ cables eastward of the end of the southern prong.

The shorebank surrounding the southern point of Ledaung kyun extends about one cable southward, and outside it the depths increase abruptly to 40 fathoms (73^m2) about 3 cables from the point.

Laws island, known to the Burmese as Paungnetkyi, about one mile southward of Barker point, is 519 feet (158^m2) high and covered with foliage.

A light is exhibited, at an elevation of 109 feet (33^m2), from a framework iron structure, painted in red and white horizontal bands and 40 feet (12^m2) in height, situated close off the western coast of Laws island, about $3\frac{1}{2}$ cables westward of the summit of the island.

Wood harbour. — Anchorage. — Directions. — Wood harbour, entered between Kyu kyun and Catherine bluff (*Lat.* 19° 31' N., *Long.* 93° 31' E.), affords anchorage in depths of from 5 to 15 fathoms (9^m1 to 27^m4), mud, with the northern extremity of Catherine bluff bearing 274°, and a gap in the hills about $2\frac{1}{2}$ cables south-eastward of the north-western end of Tankharo island, bearing 246°.

The tidal stream runs through the entrance to Wood harbour at a rate of about 3 knots.

Vessels should approach the entrance with the north-western end of Tankharo island bearing not less than 094°, in order to avoid an area with irregular depths which extends north-north-westward from Sinbaikchaing.

A boat channel for craft with local knowledge leads from Wood harbour to the head of Kyaukpyu harbour, passing close along the north-eastern coast of Tankharo island.

Southern side of Kyaukpyu harbour. — Islands and dangers. — Buoyage. — Saddle island (Pyu kyun) has two rounded summits sparsely covered with trees near its northern end; numerous sunken reefs surround the island and it should not be closely approached. The channel between Saddle island and the coast eastward is not safe owing to the existence in it of numerous reefs and rocky patches.

Foul ground, on the outer edge of which the sea breaks, extends about $1\frac{1}{2}$ miles westward from Saddle island, and a reef of above-water

Chart 831, plan of Kyaukpyu harbour.

rocks extends about one mile southward of the southern point of the island to the northern side of Bowman passage.

Another area of foul ground with numerous rocks both above-water
 5 and sunken, extends about $1\frac{1}{2}$ miles northward from Saddle island and terminates in Dicey shoal, on which the sea breaks heavily. Two rocks, 6 and 5 feet (1^m8 and 1^m5) high, lie on the inner part of this area, about 4 and 7 cables, respectively, northward of Saddle island. A conical buoy is moored about $4\frac{1}{2}$ cables north-north-westward of
 10 Dicey shoal.

Cap island, situated about $1\frac{1}{2}$ miles south-eastward of the southern end of Saddle island, is 148 feet (45^m1) high and is a good mark. Knot island, situated about one mile north-north-eastward of Cap island, is 6 feet (1^m8) high and has a few shrubs on it. Both these islets are
 15 fringed by reefs and lie near the western edge of a large area of foul ground which extends from the coast of Ramree island.

The north-western part of Ramree island, which forms the southern side of Kyaukpyu harbour, is thickly wooded. Between Adams point, about three-quarters of a mile south-south-eastward of Cap island,
 20 and Georgina point, about 3 miles north-eastward, and thence to Dalhousie point, about 2 miles farther eastward, the coast consists of a succession of sandy beaches with rocky points, fronted by foul ground and shoals.

A conspicuous tree is charted on a ridge about 2 cables north-north-
 25 westward of Mount Peter, a hill 333 feet (101^m5) high, situated about half a mile eastward of Adams point. Ladiesridge extends about three-quarters of a mile south-eastward from a position about half a mile southward of Georgina point; some trees, which form a good mark when seen from westward, are charted at its north-western end at an
 30 elevation of 218 feet (66^m4).

Bombay shoal is a bank of rocky ground with depths of from $1\frac{1}{2}$ to $2\frac{3}{4}$ fathoms (2^m7 to 5^m0), situated about half a mile northward of Georgina point (*Lat. $19^\circ 26' N.$, Long. $93^\circ 31' E.$*), with a detached patch on which there is a least depth of $1\frac{3}{4}$ fathoms (3^m2) about 7 cables
 35 north-north-westward of the same point; the shoal is generally marked by overfalls. A conical buoy is moored about one cable northward of the northern extremity of Bombay shoal.

A $2\frac{3}{4}$ -fathom (5^m0) patch lies about $1\frac{1}{2}$ miles west-north-westward of Georgina point and another patch of similar depth lies about three-
 40 quarters of a mile north-eastward of the same point.

Reliance shoal, with a depth of $1\frac{3}{4}$ fathoms (3^m2) over it, lies about $1\frac{1}{2}$ miles north-eastward of Georgina point; the surrounding depths are irregular and a $4\frac{1}{2}$ -fathom (7^m8) patch lies about $1\frac{1}{2}$ cables south-
 45 ward of Reliance shoal. A light-buoy, exhibiting a *white flashing* light every second, is moored close westward of Reliance shoal.

Dalhousie point, which is low and sandy, is well marked by high trees, and on it is a large clump of palm trees and the remains of a fort; an iron pier, with depths of 2 fathoms (3^m7) alongside it, is situated about $1\frac{1}{2}$ cables south-eastward of the point. A shoal, over which
 50 there is a least depth of $2\frac{3}{4}$ fathoms (5^m0), lies about 3 cables east-south-eastward of the pier and about $2\frac{1}{2}$ cables offshore.

A sandy beach with a foreshore of mud which dries from $1\frac{1}{2}$ to 2 cables from high water mark, extends between Dalhousie point and the entrance to Ngalapwe creek, about $1\frac{3}{4}$ miles south-eastward.

Chart 831, plan of Kyaukpyu harbour.

Anchorage.—The best anchorage is south-eastward of Dalhousie point, in depths of from 9 to 10 fathoms (16^m5 to 18^m3), mud, with the pier bearing between 271° and 288°, distant about half a mile. There are strong eddies at this anchorage at springs, but at neaps the tidal streams here are weak. 5

Anchorage may also be obtained in Southampton road, eastward of Dicey shoal, but the holding ground consists of broken shells and stones and is not good.

The anchorage in Wood harbour is described on page 279. 10

Quarantine.—See quarantine regulations on page 40.

Vessels suspected of, or infected with, yellow fever must anchor not less than half a mile from the shore in any part of the harbour eastward of Dalhousie point: vessels with other diseases may proceed to the usual anchorage within the port limits. 15

Currents.—**Tidal streams.**—In the offing the drift of the North-east and South-west monsoons will be experienced.

The rate of the tidal stream varies from one knot to 3 knots; outside Saddle island the tidal stream sets northward with the rising tide, and southward with the falling tide, frequently with considerable velocity, but the streams are very weak at neaps. Amongst the islands the streams follow the direction of the channels. 20

Charts 1369, 831.

Directions.—Vessels from westward or north-westward should approach Kyaukpyu harbour with Kyaukpandu bearing 091°, and it should not be brought to bear less than 091° until North Terrible bears more than 212°, or Saddle island (Pyu kyun) bears 119°; course should then be altered to starboard and the harbour entered with the summit of Laws island (Paungnetkyi) bearing 099°, see view on chart 831, passing southward of Giles shoal and North shoal, and northward of Dicey shoal and Reliance shoal. After passing the latter shoal, course may be shaped as necessary for the anchorage south-eastward of Dalhousie point. 25 30

The passage inside the Terribles should not be attempted by sailing vessels, but power vessels from southward may pass between the Terribles and Irrawaddy rock. Vessels should approach with the summit of Nasapo kyun (page 276) bearing 029°, and in line with the northern extremity of Nakhaungbauk kyun; great caution is, however, necessary as volcanic upheavals occurred in this vicinity in 1909, see page 43. When South Terrible bears 316°, course should be shaped to make good 001°, passing about 2 miles westward of Irrawaddy rock, and when the summit of Nasapo kyun bears 040° and is well open north-westward of Nakhaungbauk kyun, it should be steered for on that bearing until the summit of Laws island bears 099°, when the directions given above should be followed. 35 40 45

Vessels from southward with local knowledge may pass through Dickenson channel, between Irrawaddy rock and the foul ground westward of Saddle island, by keeping Seppings peak (*Lat. 19° 40' N., Long. 93° 35' E.*), which will be seen over the middle of Nakhaungbauk kyun, bearing 033°. 50

Chart 831, plan of Kyaukpyu harbour.

Town.—Kyaukpyu town, situated about three-quarters of a mile south-eastward of Dalhousie point, is bounded south-westward by a low

Charts 821, 829, 70.

Chart 831, plan of Kyaukpyu harbour.

range of sandstone hills. It is the headquarters of the Kyaukpyu district. In 1931, the population of Kyaukpyu was 4,232.

There is regular sea communication with Calcutta and Rangoon.

5 Chart 831.

WESTERN COAST OF RAMREE ISLAND.—West point to Rocky point.—Coast.—Beacon.—West point, the western extremity of Ramree island, is situated about 2 miles south-south-westward of Adams point (page 280). Between West point and Thames point, a low point with some tall trees on it, situated about $14\frac{1}{2}$ miles south-south-eastward, the coast has a rocky appearance and rises steeply to a range of high hills, the most prominent peaks of which are Outer peak, Aledeing taung (North Paps) and Tree summit.

Outer peak, about one mile south-eastward of West point, is 420 feet (128^m0) high and comparatively bare, although the range southward of it, which attains an elevation of 540 feet (164^m6), is thickly wooded.

Black hill, 410 feet (125^m0) high, about $2\frac{1}{2}$ miles north-eastward of Outer peak, and Pimple hill, 465 feet (141^m7) high, about $4\frac{1}{2}$ miles south-eastward of it, are both black hills and are named from their appearance as seen from seaward; they are unmistakable when not obscured by the coastal range.

Aledeing taung, 455 feet (138^m7) high, about 5 miles south-south-eastward of Outer peak, is the most distinctive hill on this stretch of coast; there is a conspicuous bungalow on the coast at its foot near Minbyin village.

Brown hill, 376 feet (114^m6) high, about $4\frac{3}{4}$ miles south-south-eastward of Aledeing taung, is so named on account of its colour as compared with other hills in the vicinity; close south-eastward of it is Tree summit, 420 feet (128^m0) high, which is easily identified by a tall tree surmounting it.

From Thames point, the coast trends south-south-eastward for about 10 miles to Rocky point, a low point marked by a white pole beacon, 15 feet (4^m6) high.

35 Off-lying dangers.—The Terribles and Irrawaddy rock are described on page 277.

A number of rocks and shoals, the positions of which may best be seen on the chart, lie inside a distance of $1\frac{1}{2}$ miles from the coast between Adams point and Rocky point.

40 Research rock, about $2\frac{3}{4}$ miles south-south-westward of West point, is a sunken reef with depths of less than 6 feet (1^m8) over its centre.

Charts 831, 832.

CHEDUBA STRAIT AND APPROACHES. — Caution.—Cheduba strait, which lies between Ramree island and Cheduba island, is entered between Rocky point (*see above*) and Searle point, the northern extremity of Cheduba island, about $6\frac{1}{2}$ miles south-westward; there is a least depth of $3\frac{1}{2}$ fathoms (6^m4) in the recommended navigable channel through the strait.

Mud volcanoes, *see* page 43, frequently raise islets and shoals both in the strait and in the adjacent waters.

Light.—Beacon.—Beacon island (*Lat.* 18° 56' N., *Long.* 93° 27' E.), an islet situated about 9 miles westward of Searle point and about

Charts 821, 829, 70.

Charts 831, 832.

4 miles north-north-westward of the north-western extremity of Cheduba island, is 30 feet (9^m1) high and is composed of stones.

A light is exhibited, at an elevation of 122 feet (37^m2), from a red iron tower with a white band, 119 feet (36^m3) in height, situated on the eastern summit of Beacon island. 5

A white stone beacon, 17 feet (5^m2) in height, stands on the highest point of the island.

Dangers in approach.—Two islets, about 25 feet (7^m6) high and 400 feet (121^m9) long, were reported in 1919 to have formed in positions about 8 and 6 miles, respectively, north-north-westward of Beacon island. 10

An islet, reported to have formed in 1918, about 1½ miles south-westward of the position of the northernmost of the two islets mentioned above, has been washed away, leaving only a shoal, over which the sea breaks heavily during the South-west monsoon, surrounded by depths of from 8 to 10 fathoms (14^m6 to 18^m3). A rock with a depth of 5 fathoms (9^m1) over it, which breaks in heavy weather, is situated about 2 miles south-south-eastward of this shoal. 15

As the result of an eruption of a mud volcano in 1906, an island was thrown up about 5 miles north-north-westward of Beacon island, which, in 1907, was 19 feet (5^m8) high; this island was completely washed away, leaving a shoal, on which, in 1918, an islet was reported to have formed. This islet has been washed away, leaving a shoal, over which the sea breaks heavily during the South-west monsoon. 20

In 1917, active mud volcanoes were reported in a position about 5 miles north-westward of Beacon island. In this locality, the sea breaks heavily in a flat calm and is surrounded by large areas of light-coloured water in patches of irregular shape. 25

In 1936, a small volcanic islet was reported in a position about 2½ miles east-north-eastward of Beacon island lighthouse. 30

Outer part of Cheduba strait.—Dangers.—On the northern side of the entrance to the strait, Dark hill, 256 feet (78^m0) high and wooded, situated about 2½ miles eastward of Rocky point, and Helby hummock, a small wooded hill about one mile farther south-south-eastward which is prominent from north-westward, stand on the eastern side of a bight formed between Rocky point and a point about 4 miles south-eastward. Zikha taung (Highest summit), 999 feet (304^m5) high and the highest summit on Ramree island, lies about 7½ miles east-south-eastward of Helby hummock. 35

Between Rocky point and Button island, an islet 116 feet (35^m4) high, lying about 8½ miles east-south-eastward and about a quarter of a mile offshore, the northern side of the strait is fronted by a bank which, with depths of less than 3 fathoms (5^m5) on it, extends about one mile offshore in places; from westward, Button island is inconspicuous. 40

On the southern side of the strait, the whole of the northern coast of Cheduba island is low between the western extremity, on which is a mud volcano, and Sandy point (*Lat. 18° 53' N., Long. 93° 45' E.*), the north-eastern extremity of the island, about 15 miles eastward. 45

Shoal ground, with depths of 3 fathoms (5^m5) or less, extends as much as 2½ miles off the northern coast of Cheduba island and, in the area contained between lines joining Beacon island, the north-western extremity of Cheduba island, and Searle point, there are rocks, shoals and large boulders, some of which dry. 50

Charts 821, 829, 70.

Charts 831, 832.

A 3-fathom (5^m5) patch lies nearly in the middle of the entrance to the strait, about 3 miles south-south-westward of Rocky point ; it is the westernmost patch of a line of shoals with a least depth of 1½ fathoms (2^m3) which extends east-south-eastward for about 4½ miles from it ; the recommended track, which is indicated on the chart by pecked lines, passes northward of these shoals.

A mud volcano shoal with depths of 1½ fathoms (2^m7) over it, is situated about 2 miles north-north-eastward of Sandy point. The track recommended passes about 2 cables eastward of this shoal, and vessels should exercise great caution when in its vicinity.

Chart 832.

Inner part of Cheduba strait.—Dangers.—Between Button island and the southern point of Ramree island about 8½ miles south-eastward, the north-eastern side of the strait is fringed by rocks to a distance of about half a mile offshore. A dome-shaped hill, 399 feet (121^m6) high, stands close to the coast, about 3¼ miles south-eastward of Zikha taung, and marks the south-eastern end of the coastal range on the western side of Ramree island.

From Sandy point the eastern coast of Cheduba island, which forms the western shore of Cheduba strait, trends southward for about 13 miles to the southernmost point of the island ; it is low and thickly wooded for about 8 miles from Sandy point, southward of which it becomes high. The entrance to On chaung (Cheduba creek), which leads to the town of Cheduba, lies about 2 miles southward of Sandy point, and a pagoda, which is newly whitewashed every autumn and a good mark at that time, stands about 6 cables north-westward of the entrance to On chaung.

A bank on which the depths are less than 3 fathoms (5^m5), extends from 2 to 6 miles off the eastern coast of Cheduba island. Taik kyun (Tokwekwong), 244 feet (74^m4) high, with an even and rounded summit, lies near the edge of the bank, about 10 miles south-south-eastward of Sandy point.

Middle ground, a bank with depths of from 2½ to 3 fathoms (4^m1 to 5^m5), obstructs the greater part of the strait between Sandy point and the southern extremity of Ramree island, about 11 miles eastward. Between the eastern edge of the bank extending off Sandy point and the western side of Middle ground, the channel is about one mile in width with a least depth of 3½ fathoms on the track recommended ; and between the eastern side of Middle ground and the western side of the southern extremity of Ramree island, the channel has a width of about 3 cables with a least depth of 3¼ fathoms (5^m9).

Charts 831, 832.

Anchorage. — Directions. — Anchorage with excellent holding ground may be obtained with Beacon island bearing about 215°, distant 1½ miles.

Approaching Cheduba strait from north-westward, the hills on Cheduba island will be seen south-eastward, Ywathit taung (Centre peak), about 6 miles within the northern coast, being the most isolated and prominent, with Taungni taung (Pagoda peak) about 2 miles southward of it. The high hills on Ramree island on the northern side of the strait will be seen farther eastward ; they fall somewhat abruptly at their south-eastern end, their highest point being marked by a slight hump. On a closer approach, Helby hummock (*Lat.* 19° 00' N.,

Charts 821, 829, 70.

Charts 831, 832.

Long. 93° 44' E.), with Dark hill northward of it, will be seen in the same direction over the low ground of Rocky point.

From a position about 5 miles westward of Rocky point, with Zikha taung bearing 102° and Ywathit taung bearing 170°, vessels should 5
steer along the track recommended, indicated on the chart by a pecked line, keeping the dome-shaped hill, 399 feet (121^m6) high, bearing about 109°, until Dark hill bears 338°, when course should be altered southward to about 158° and Dark hill kept bearing 338° astern. As 10
this course passes close eastward of the above-mentioned mud volcano north-north-eastward of Sandy point, care should be taken not to bring Dark hill to bear more than 338°.

Chart 832.

After proceeding about 2 miles on this latter course, a bare, blunt and conical hill will appear open westward of Dark hill, *see* view on 15
chart 832.

As the edge of the bank fronting the eastern coast of Cheduba island is very steep-to in places, preference should here be given to the eastern or Middle ground side of the channel, Middle ground being cleared 20
when Taik kyun bears 203°.

From abreast Taik kyun, the blunt conical hill and Dark hill are just visible above the horizon and appear as a hill with twin summits.

CHEDUBA ISLAND.—Aspect.—Cheduba island is well-wooded and has a considerable amount of undulating country. It is roughly 25
triangular in shape, the northern coast being low, the eastern coast flat, whilst the south-western coast is high. The northern and eastern coasts are described with Cheduba strait, *see* above.

Ywathit taung (Centre peak), situated about 7 miles southward of Searle point, is 565 feet (172^m2) high and is a good mark. Taungni 30
taung (Pagoda peak), 642 feet (195^m7) high, about 2 miles farther southward, has on its summit two small pagodas with a single tree between them. Palēngu taung (Palangutaung), about 6½ miles south-eastward of Taungni taung, and about three-quarters of a mile within the southern point of the island, rises to an elevation of 845 feet (257^m5). 35
The greater part of the island is cultivated and covered with foliage.

An active mud volcano which discharges inflammable gas, is situated a short distance north-westward of Palēngu taung; an eruption from it was observed in 1884.

South-western coast. — Off-lying dangers. — The south-west- 40
ern coast of Cheduba island, between the north-western point of the island and the coast abreast Palēngu taung, about 17 miles south-eastward, is bold and is fronted by numerous detached rocks, both above-water and sunken. Native craft frequent this coast during the North-east monsoon. 45

Henry rocks are a group of rocks lying on a reef which extends about 1½ miles south-westward from a position about 2 miles westward of the north-western point of Cheduba island; there is one pinnacle, 17 feet (5^m2) high, in the group, and near its south-western extremity are two rocks, 4 feet (1^m2) high. Oyster rock, an above-water rock, 50
lies about 1½ miles south-eastward of Henry rocks.

West hill, 609 feet (185^m6) high and wooded, is situated about 7 miles south-eastward of the north-western point of the island and

Charts 821, 829, 70.

Chart 832.

about $1\frac{1}{2}$ miles inland ; West hummock, 127 feet (38^m7) high, stands on the coast about 2 miles westward of West hill.

A rock, awash, lies about $1\frac{1}{4}$ miles offshore west-south-westward of
5 West hummock (*Lat.* 18° 47' N., *Long.* 93° 32' E.).

The only indentation on the south-western side of the island is near its southern end, close westward of Palēngu taung, where Pyramid bay affords good anchorage to native craft during the North-east monsoon. Natmyat kyauk (Pyramid rock), a pinnacle rock, 202 feet (61^m6)
10 high, lies off the entrance to Pyramid bay.

A reef, on which are many above-water and sunken rocks, extends about 2 miles southward from Pyramid rock, and from this reef, an extensive area of foul ground extends eastward to Ye kyun, *see* below.

Tidal streams.—The tidal streams on the south-western side of
15 Cheduba island follow the general trend of the land, but there is a considerable indraught between Cheduba island and Ye kyun (Flatt island), situated about 5 miles east-south-eastward of the southern point of Cheduba island. During the North-east monsoon there may be a southgoing current. During the northgoing stream there are
20 strong insets into the numerous rivers and creeks.

RAMREE HARBOUR AND APPROACHES.—Ramree harbour, which is really the estuary of Kaleindaung river, lies between the southern part of Ramree island and the mainland eastward of it, and affords sheltered anchorage to all types of vessels in depths of up
25 to 10 fathoms (18^m3). There are numerous islands, rocks and shoals, both in the entrance to the harbour and in the southern approach to it.

Islands and dangers in the approaches.—**Channels.**—A chain of islands, rocks and shoals extends between the southern end of Cheduba island and the mainland about 60 miles south-eastward ; in
30 the north-western part of this chain, there are three principal channels.

Ye kyun (Flatt island) lies near the edge of the foul ground which extends about 7 miles south-eastward from the south-eastern extremity of Cheduba island ; it is low generally, but rises in the centre to an elevation of 152 feet (46^m3). Taung kyun (Hill island), 16 feet (4^m9)
35 high, lies about three-quarters of a mile southward of the southern extremity of Ye kyun. Foul ground, on which is South rock, 8 feet (2^m4) high, extends about one mile southward of Taung kyun and is steep-to.

There is no clear passage between Ye kyun and Cheduba island, and
40 numerous reefs extend between and around Ye kyun and Taung kyun, and also between the northern point of Ye kyun and Taik kyun, about 3 miles northward. Taung kyun should not be approached on its western, southern and eastern sides within a distance of $1\frac{1}{2}$ miles.

In January, 1912, a submarine volcanic eruption occurred about
45 3 miles south-westward of the northern extremity of Ye kyun.

West shoal, a small group of sunken rocks, lies about 5 miles south-south-eastward of Taung kyun ; the rocks are visible between the rollers at low water, but the sea does not always break on them. A line of rocks and shoals extends about $5\frac{1}{2}$ miles north-north-eastward from
50 a position about $2\frac{1}{2}$ miles north-eastward of West shoal. Sail rock, situated at the southern end of this foul ground, about 5 miles east-south-eastward of Taung kyun, is 8 feet (2^m4) high ; a rock, awash, lies about half a mile southward of it. False rock, 10 feet (3^m0) high,

Chart 832.

lies near the northern end of this foul ground, about $4\frac{1}{2}$ miles north-north-eastward of Sail rock, with no safe passage between them.

Heywood channel lies between Ye kyun and Taung kyun on the west, and the foul ground between Sail rock and False rock on the east. 5 It is about 8 cables wide at its narrowest part north-westward of False rock, with a least depth of $5\frac{1}{2}$ fathoms (9^m6), but Heywood channel is not recommended.

Unguan island, situated about 11 miles south-eastward of Taung kyun, is 130 feet (39^m6) high and has a dense clump of trees on its 10 summit. It is surrounded by foul ground which, except on its western side, extends for about one mile in all directions.

Three patches lie on a line south-westward of the northern point of Unguan island; the outermost patch, about 3 miles distant, has a least depth of 7 fathoms (12^m8) over it. A $6\frac{1}{2}$ -fathom (11^m9) rocky patch 15 lies about $4\frac{1}{2}$ miles south-south-westward of the island.

Cutters patch (*Lat.* $18^\circ 29' N.$, *Long.* $93^\circ 54' E.$), a small shoal with a least depth of $2\frac{1}{2}$ fathoms (4^m6), rock, over it, lies about 2 miles north-north-westward of Unguan island.

East reef, situated about 4 miles north-north-eastward of Unguan 20 island, dries about 4 feet (1^m2). Depths of less than 5 fathoms (9^m1) extend about three-quarters of a mile north-eastward from the reef.

Childers channel lies between West shoal, Sail rock and False rock on the north-west, and Unguan island and East reef on the south-east; 25 it is about 4 miles wide, has a least depth of 9 fathoms (16^m5), and is a good channel to use when the sea is breaking on West shoal.

Charts 832, 3771.

Nerbudda shoal is an extensive shoal about 5 miles south-eastward of Unguan island; it has a least depth of $1\frac{1}{2}$ fathoms (2^m7) near its 30 north-western end, about 4 miles east-south-eastward of Unguan island.

Nerbudda island, a mud volcano, lies at the south-western end of Nerbudda shoal, about 5 miles south-south-eastward of Unguan island; in April, 1908, it was in a violent state of eruption and was then seen from the mainland at a distance of about 25 miles. In 1909, it was 35 about 3 cables in extent, one foot (0^m3) high, and the sea broke over it, but it was considered probable that it would not remain visible at high water for any length of time.

A patch of coral, with a least depth of 8 fathoms (14^m6) over it, lies about $2\frac{3}{4}$ miles south-westward of Nerbudda island. 40

The channel between Unguan island and Nerbudda shoal is about 3 miles wide at its narrowest part with a least depth of 11 fathoms (20^m1); it is much used, owing to the fact that it is well marked by Unguan island.

The dangers south-eastward of Nerbudda shoal are described on 45 page 293.

Chart 832.

Gungasager rocks are a group of rocks 3 feet (0^m8) high, situated about 13 miles eastward of False rock; they lie at the south-western end of a shoal which, with depths of less than 5 fathoms (9^m1) over it, 50 extends about $1\frac{3}{4}$ miles north-eastward. Foul ground, with depths of from $3\frac{3}{4}$ to $4\frac{1}{4}$ fathoms (6^m9 to 7^m8), lies about 2 miles northward of Gungasager rocks.

Osprey rocks are a group of rocks, 8 feet (2^m4) high, which lie on

Charts 829, 70.

Chart 832.

a shoal with depths of less than 3 fathoms (5^m5) over it, situated about 5 miles north-westward of Gungasager rocks.

Pantaw (Pandaw) rocks are a group of low rocks, the north-western-most of which is 2 feet (0^m6) high, situated about 4 miles east-north-eastward of Osprey rocks.

Tidal streams.—The tidal streams off the coast in this vicinity set northward during the rising tide and southward during the falling tide. There are no strong tidal streams between Kyaukpyu (page 276) and Sandoway, about 30 miles east-south-eastward of the southern end of Cheduba island, except at the entrance to Ramree harbour.

Entrance to Ramree harbour.—Islands and dangers.—

Beacon.—Ramree harbour is entered between the southern point of Ramree island (*Lat. 18° 51' N., Long. 93° 56' E.*), situated about 11 miles eastward of Sandy point (page 283), and the coast of the mainland about 5½ miles eastward, but the entrance is obstructed by a group of islands which divides it into two parts. The main entrance channel, which is known as The Gates, and in which there are considerable depths, lies between the southern point of Ramree island and the western and northern coasts of Sagu kyun, the northernmost and largest of the group of islands in the entrance. The entrance eastward of the group of islands is encumbered with mud and sandbanks through which there are some narrow channels only suitable for fishing craft, the positions of which may best be seen on the chart.

Magyi kyun (Magyigyun), situated about 8 miles south-south-eastward of the southern point of Ramree island, is the southernmost of the group of islands in the entrance; it is 261 feet (79^m5) high, whale-backed and surrounded by foul ground. Nyaungbin kyun (Nyaungbinchaung) lies on the edge of the foul ground, about three-quarters of a mile south-westward of the south-western point of Magyi kyun. Baung kyun (Tangagyochaung) lies in the middle of the foul ground which extends about 1½ miles westward from the north-western point of Magyi kyun.

Sagu kyun, about 2 miles north-north-westward of Magyi kyun, attains an elevation of 272 feet (82^m9) near its south-western side. Naga taung, an isolated clump of trees, 200 feet (61^m0) high, situated close to the northern coast of the island, about 1¼ miles west-north-westward of the northern extremity and about 1½ miles south-south-eastward of the southern point of Ramree island, is a prominent mark, as also is another clump about half a mile farther west-south-westward.

Sagu kyun is fringed on its western, southern and eastern sides by a reef with numerous offshore rocks; Big rock, 60 feet (18^m3) high, lies on this reef close off the southern coast of the island with Kyuntalaung (Chaungdalaung), 155 feet (47^m2) high, about one mile east-south-eastward of it.

Alligator rocks, a group of rocks which dry, lie close off the northern coast of Sagu kyun, about half a mile northward of Naga taung. A reef extends about one mile north-north-eastward from the northern part of the eastern side of the island; a beacon, situated about three-quarters of a mile north-eastward of the northern point of the island, marks the north-eastern extremity of the reef. A 2-fathom (3^m7) patch lies about 3 cables north-westward of the beacon.

Dangers in Ramree harbour.—Beacons.—Dragon shoal, parts of which dry, extends about 3¾ miles north-north-eastward from a

Chart 832.

position about one mile northward of the beacon marking the shoal which extends from Sagu kyun. White rock, situated about $3\frac{1}{2}$ miles north-north-eastward of the above-mentioned beacon, is 3 feet (0^m9) high, and forms one of a group of above-water rocks; two rocks awash, with a 2-fathom (3^m7) patch between them, lie about 6 cables north-north-westward, and 9 cables north-north-eastward, respectively, of White rock. 5

Two white marks have been established on the western shore of the harbour, about $1\frac{1}{4}$ and $3\frac{3}{4}$ miles, respectively, north-north-eastward of the southern point of Ramree island; rocky patches, with depths on them of from $2\frac{1}{4}$ to $3\frac{1}{4}$ fathoms (4^m1 to 5^m9), lie about three-quarters of a mile eastward of the southern white mark. The fairway of the channel lies between these rocky patches and the western edge of Dragon shoal and, westward of the latter shoal, is about three-quarters of a mile wide with depths of from $6\frac{1}{2}$ to 11 fathoms (11^m4 to 20^m1). 10 15

Flat reef (*Lat.* 18° 55' N., *Long.* 94° 00' E.), a patch of rocks which dries and is steep-to except on its southern side, where depths of $2\frac{1}{2}$ fathoms (4^m6) and less extend for about 4 cables southward, lies about three-quarters of a mile north-north-westward of Dragon shoal. Two beacons, situated respectively, about $1\frac{1}{4}$ miles northward, and $1\frac{1}{2}$ miles north-north-westward of White rock, mark the eastern and western sides of Flat reef. The reef may be passed on either side, but the channel between it and the north-western side of Dragon shoal, which is about 2 cables wide, is that generally used. 20 25

Low islet, on which is a beacon and which is steep-to on its eastern side, lies about $2\frac{1}{4}$ miles northward of Flat reef and about half a mile south-eastward of a bluff point, 100 feet (30^m5) high, on the western shore of the harbour. About midway between Low islet and a third white mark on the western shore, about $1\frac{1}{2}$ miles north-north-westward, is a shoal which is nearly awash. 30

Oyster reef, which lies about 2 miles northward of the third white mark and about half a mile off the western shore of the harbour, covers at high water, springs, and is marked by a beacon; Cutters rock lies about one mile northward of Oyster reef and about $1\frac{1}{4}$ miles eastward of Taraung taung (Tree on bluff), a bluff on which is a prominent tree. 35

Between Cutters rock and the entrance to Tan chaung (Ramree river), about 4 miles north-north-westward, there are depths of from $3\frac{1}{4}$ to $4\frac{1}{4}$ fathoms (5^m9 to 7^m8), but the navigable channel is narrowed by mudbanks which extend about 3 miles south-south-westward from an island situated about 3 miles eastward of the entrance to Tan chaung. Middle bank, which lies about one mile south-westward of this island, partly dries, and there is a group of rocks, awash, on its western side, about 2 miles eastward of the entrance to Tan chaung. 40 45

Nepal rock, situated in mid-channel about one mile eastward of the entrance to Tan chaung, has a least depth of $1\frac{1}{2}$ fathoms (2^m3) and a swirl is often visible over it.

Between Nepal rock and the narrow entrance to Mingaug chaung, about 2 miles northward, there are depths in the fairway of from 4 to 7 fathoms (7^m3 to 12^m8). Mingaug chaung connects the head of Ramree harbour with the inner part of Kyaukpyu harbour and is available to vessels of a draught not exceeding 8 feet (2^m4). 50

Anchorage.—Excellent anchorage may be obtained in Ramree

Chart 832.

harbour, anywhere which is clear of the numerous rocks, shoals and fishing stakes, in depths of up to 10 fathoms (18^m3).

Tidal streams.—In the harbour, the tidal stream sets northward 5 during the rising tide and southward during the falling tide, at a rate of 3 knots; in The Gates, the stream follows the direction of the channel at a rate of from 3 to 4 knots.

Directions.—Caution.—Vessels approaching Ramree harbour from southward, and using the channel between Unguan island and Nerbudda 10 shoal, should keep Unguan island bearing more than 350° until well northward of Nerbudda island, when course should be shaped to make good 046°, which leads through in mid-channel. If approaching from south-eastward, vessels should pass south-westward of Gungasager and Osprey rocks, at distances of about 2 and 2½ miles, respectively. 15 If bound for Ramree harbour through The Gates, vessels should shape course to pass between 2½ and 4 miles westward of Magyi kyun, and should thence steer a northerly course, avoiding the fishing stakes which are charted in this channel, and proceed through The Gates in mid-channel, on a course of about 054°. When the northern point of 20 Sagu kyun (*Lat. 18° 50' N., Long. 93° 58' E.*) bears about 140°, course should be altered northward, and the western of the two clumps of trees on the northern coast of Sagu kyun, kept bearing 208°, astern, which leads through the narrow channel between Dragon shoal and Flat reef; vessels are here cautioned to keep to the deeper water 25 towards Flat reef.

Having passed Flat reef, course should be shaped to pass about half a mile eastward of Low islet beacon, and thence at a similar distance eastward of Oyster reef and Cutters rock, avoiding the fishing stakes 30 charted about one mile north-north-eastward of Low islet. When northward of Cutters rock, vessels should keep about three-quarters of a mile from the western shore of the harbour to the entrance to Tan chaung.

Caution is necessary between White rock and Flat reef and in the vicinity of Oyster reef, Cutters rock and Nepal rock.

35 **Town.**—The town of Ramree is situated at the head of Tan chaung, about 5 miles westward of the entrance. At ordinary high water, vessels with local knowledge and of a draught not exceeding 9 feet (2^m7), can enter Tan chaung and proceed to within 1½ miles of the town, where there is a wharf which is connected with the town by road.

40 There is regular sea communication by local craft with Kyaukpyu, Cheduba and Sandoway (page 292).

KAYAING RIVER ENTRANCE TO PAGODA POINT.—

Coast.—Dangers.—Kayaing river is entered about 7½ miles eastward of Magyi kyun. Taungup chaung, on the southern bank of which is 45 the village of Taungup, about 7½ miles above the entrance, and Thinganet chaung, which runs south-eastward of Taungup chaung and connects with it about 4 miles below the village, both flow into the northern side of the estuary of Kayaing river. About 1½ miles below Taungup village, Taungup chaung narrows to a width of about 50 feet 50 (15^m2) and is barely navigable by a steam launch.

Between the southern entrance point of Kayaing river and the south-western point of Singaung kyun, about 13 miles south-south-eastward, the coast is formed by a series of long, low islands, and

Charts 821, 829, 70.

Chart 832.

backed about 25 miles inland by the mountains of Kyaukpyu range. Singaung reef, on which are numerous rocks, both above-water and sunken, extends about 2 miles west-south-westward of the northern extremity of Singaung kyun, about $3\frac{1}{2}$ miles northward of the south- 5 western point of that island.

Whaler's rock, awash, lies about $2\frac{1}{2}$ miles west-north-westward of the northern point of Singaung kyun and about 2 miles offshore. Pantaw rocks, lying about $4\frac{1}{2}$ miles north-westward, and Gungasager rocks, about a similar distance west-south-westward, of Whaler's rock, 10 are described on page 287.

A remarkable tufted clump of trees, 146 feet (44^m5) high, is situated about $1\frac{1}{2}$ miles southward of the northern point of Singaung kyun, and a rest house stands on the south-western point of the island; this latter point is fronted by a drying sandspit which extends about half 15 a mile westward, and a shoal bank with depths of less than 2 fathoms (3^m7), extends about three-quarters of a mile westward from the outer edge of the sandspit.

Drunken Sailor rock (*Lat. $18^\circ 33' N.$, Long. $94^\circ 13' E.$*), a part of which nearly dries, lies about 2 miles westward of the south-western 20 point of Singaung kyun. The sea usually breaks over it at low water and, with only a slight swell, its position is clearly indicated between half ebb and half flood.

The south-western point of Singaung kyun forms the northern entrance point of Sandoway river. Zalat taung, 171 feet (52^m1) high, 25 lies on the southern side of the entrance to Sandoway river, about three-quarters of a mile west-south-westward of its northern entrance point. Rocks and foul ground extend about three-quarters of a mile south-south-westward from the western end of Zalat taung, outside which depths of 4 and 5 fathoms (7^m3 and 9^m1) extend for about 6 cables 30 farther south-westward.

Singyat kyun lies close south-eastward of Zalat taung, separated from it by a narrow channel filled with rocks.

Gaw taung (Gwataung), 553 feet (168^m5) high, about 3 miles south-south-eastward of the south-western point of Singaung kyun, is a good 35 landmark and is readily identified, being the only hill of considerable elevation on this part of the coast.

Anchorage.—There is anchorage about $1\frac{1}{2}$ miles northward of Drunken Sailor rock, in a depth of 6 fathoms (11^m0), mud, with the rest-house bearing 120° , and the remarkable tufted clump of trees 40 bearing 071° .

Vessels with local knowledge may find good anchorage southward of Drunken Sailor rock during the North-east monsoon, but during the South-west monsoon, it is exposed and dangerous.

Sandoway river.—Directions.—Sandoway river enters the sea 45 between the drying sandspit extending westward from the south-western point of Singaung kyun, and Zalat taung. The river is tidal for a short distance above the town of Sandoway, situated about 15 miles above the entrance. Power vessels with local knowledge, of a draught not exceeding 8 feet (2^m4), can, at ordinary high water, 50 ascend the river to within about 4 miles of the town, and those with a draught of 3 feet (0^m9), as far as Sandoway town. The port of Sandoway is considered closed during the South-west monsoon.

When the wind is westward of north, a heavy surf breaks along the

Chart 832.

coast in the vicinity of the river mouth, making landing in boats hazardous.

- Vessels entering Sandoway river should approach the entrance keeping the rest-house bearing about 081° , which leads southward of Drunken Sailor rock through the fairway of the entrance; when the summit of Zalataung bears 181° , course should be altered southward to round the sandspit which fronts the rest-house.

Chart 829.

- Sandoway town, the headquarters of Sandoway district, stands on the west bank of the river; it lies in a hollow surrounded by hills, the native town being backed by a hill on which stands the civil station. In 1931 the population of Sandoway (*Lat.* $18^{\circ} 28' N.$, *Long.* $94^{\circ} 21' E.$) was 4,070.
- There is regular sea communication with Chittagong and Rangoon via Andrew bay (*see below*), except during the South-west monsoon. A steam launch maintains communication between the roadstead and the town.

- Climate.**—In the cool season, from November to February, the dew is exceedingly heavy, and the nights are chilly. From February to May there are dense fogs during the evenings and mornings. *See also Local winds, Arakan coast, page 61.*

Charts 832, 3771.

- Sandoway river entrance to Apau-ye-kyun.—Coast.**—The district of Sandoway is mountainous, the Arakan Yoma range sending out spurs which reach the coast, and these spurs in turn throw out a number of side spurs parallel with the main range. The rivers draining the district are but mountain torrents to within a few miles of the sea, and southward of Sandoway river the coast is rugged with few places of shelter.

- Between Gawtaung and the coast abreast Apau-ye-kyun, a bluff islet, 203 feet (61^m9) high, situated close offshore about $8\frac{1}{2}$ miles south-south-eastward, the coast is low and sandy and is fringed by rocks both sunken and awash, which, near the southern end of the stretch, lie as much as $1\frac{1}{2}$ miles offshore. A $3\frac{1}{2}$ -fathom (6^m4) patch, lies about $2\frac{3}{4}$ miles north-north-westward of Apau-ye-kyun and about $1\frac{1}{2}$ miles offshore.

- In 1933, two mud volcanoes were reported in positions about $1\frac{1}{2}$ miles westward, and 8 cables south-south-westward, respectively, of the western point of Apau-ye-kyun.

Chart 3771.

- Andrew bay.—Light.—Caution.—Anchorage.**—Andrew bay is entered between a point situated about one mile south-eastward of Apau-ye-kyun, and Money point, about 3 miles south-south-westward. The middle of the bay is clear of dangers and affords good anchorage in fine weather with good holding ground, but it is exposed to the full force of the South-west monsoon.

- A light is exhibited, at an elevation of 110 feet (33^m5), from a red framework iron structure, 10 feet (3^m0) in height, situated about a quarter of a mile within the northern entrance point of Andrew bay.

Considerably shoaler depths than shown on the chart were reported in 1936.

Money point is the extremity of a small peninsula which rises to an elevation of 395 feet (120^m4) at Taunmagyi taung (Money summit),

Charts 829, 70.

Chart 3771.

about three-quarters of a mile south-south-westward of the point ; Taunmagyi taung is surmounted by detached trees and forms a prominent mark which may be readily identified from seaward.

Sandoway bay, immediately eastward of the northern entrance 5 point of Andrew bay, has a small stone landing jetty which is connected by road with Sandoway town, about 6 miles northward.

Mayo bay, situated near the south-eastern corner of Andrew bay, affords shelter during the South-west monsoon, but the anchorage space is restricted by a $2\frac{1}{2}$ -fathom (5^m0) patch lying near the middle 10 of the bay.

Money point to Bluff cape.—Coast.—The coast for about $4\frac{1}{2}$ miles southward of Money point forms a promontory ; a white pagoda, which from seaward forms a conspicuous mark when the sun shines on it, is situated on the southern coast of the promontory close south- 15 ward of the village of Mawyen (Hmau-gon) (*Lat. $18^{\circ} 15' N.$, Long. $94^{\circ} 20' E.$*), about three-quarters of a mile eastward of the south-western extremity of the promontory.

Foul ground, with numerous above-water and sunken rocks, fronts the western coast of the promontory to a distance of about $3\frac{1}{2}$ miles 20 offshore ; the outermost danger, a patch which dries 3 feet (0^m9), lies about $4\frac{1}{2}$ miles west-south-westward of Money point.

The southern coast of the promontory is also fronted by numerous rocks and shoals the outermost of which are :—A rock which dries 4 feet (1^m2), situated about $1\frac{1}{2}$ miles south-westward of the white 25 pagoda ; Pyin kyun, a rock 6 feet (1^m8) high, about three-quarters of a mile south-south-eastward of the pagoda ; and Kyaukchinhmaw (Remarkable rock), 30 feet (9^m1) high, about $2\frac{1}{2}$ miles east-south-eastward of the pagoda. Padaung island, an islet lying close inshore, is situated about $2\frac{1}{2}$ miles eastward of Kyaukchinhmaw. 30

From Padaung island, the coast trends southward for about 14 miles to Bluff cape, a projection which rises steeply from the sea to an elevation of 450 feet (137^m2), and from seaward, is a moderately good mark.

The mouth of Kamyit chaung lies about $3\frac{1}{2}$ miles southward of 35 Padaung island, and Salu chaung enters the sea about $1\frac{3}{4}$ miles farther southward.

Kyeintali chaung, which flows into the sea about 2 miles eastward of the projection terminating in Bluff cape, is navigable by boats. 40

Off-lying island, banks and dangers.—Light.—Caution.—Numerous shoals and banks, generally of coral formation, lie off the coast between Money point and Bluff cape, and caution is necessary when navigating in this locality, especially during the South-west monsoon. 45

Mills patch, on which there is a depth of $3\frac{1}{2}$ fathoms (5^m9), was thrown up in 1908 by a small mud volcano, and lies about $4\frac{1}{2}$ miles westward of Money point ; it forms a danger to vessels making Andrew bay.

Nerbudda shoal, Nerbudda island and the dangers north-westward 50 of them, are described on page 287.

Carpenter shoals are two separate shoal areas, the western of which lies about $6\frac{1}{2}$ miles south-south-eastward of Nerbudda island, and has a least depth of $3\frac{3}{4}$ fathoms (6^m9), coral rock, near its centre ; the

Chart 3771.

eastern shoal, situated about 3 miles east-south-eastward of the western, has a least depth of $2\frac{3}{4}$ fathoms (5^m0).

There are several banks with depths of less than 10 fathoms (18^m3) over them in the vicinity of Carpenter shoals, but no one of them constitutes a danger.

Nantha kyun (Foul island) is an active mud volcano, 551 feet (167^m9) high, situated about 20 miles west-north-westward of Bluff cape. It is thickly wooded except for a strip on its western side, where the volcano, when active, has cleared away the trees, and formed a bare lane, or course, extending down to the sea. The crater, situated westward of, and just below, the summit, was in violent eruption in February, 1908, the flames of which were reported to have reached a height of 500 feet (152^m4) above the summit. See page 43.

A light is exhibited, at an elevation of 46 feet (14^m0), from a red framework iron structure, 10 feet (3^m0) in height, situated on the western side of Nantha kyun, about 4 cables southward of the north-western extremity of the island.

Fish, especially rock cod and red mullet, are very numerous over the coral shoals in the vicinity of Nantha kyun, and are easily caught.

Good anchorage may be obtained, in depths of from 8 to 10 fathoms (14^m6 to 18^m3), sand and mud, about one mile northward of Nantha kyun.

Brougham shoal (*Lat. $18^\circ 09' N.$, Long. $94^\circ 07' E.$*), about $4\frac{1}{2}$ miles north-north-eastward of Nantha kyun, is a dangerous rocky shoal with depths of less than 6 feet (1^m8) over it; the sea nearly always breaks on it.

New shoal, about $8\frac{1}{2}$ miles east-north-eastward of Nantha kyun, has a depth of 3 fathoms (5^m5), rock, over it. Satellite ledge, about 4 miles eastward of New shoal, has depths of 14 fathoms (25^m6) over it.

Vestal shoal, about $6\frac{1}{2}$ miles eastward of Nantha kyun, has a least depth of 5 feet (1^m5) over it and is usually marked by breakers. Robinson shoal, about $1\frac{3}{4}$ miles eastward of Vestal shoal with considerable depths between them, is composed of coral and has a least depth of 4 feet (1^m2) over it; it is also usually marked by breakers. Williams shoal, about $6\frac{1}{2}$ miles westward of Bluff cape, lies at the eastern end of a bank on which the depths are less than 20 fathoms (36^m6), and has a least depth of $2\frac{1}{2}$ fathoms (4^m6), rock.

Investigator ledge, a coral ledge with a least depth of 12 fathoms (21^m9), lies about $3\frac{1}{2}$ miles south-eastward of Nantha kyun.

Vessels proceeding on the eastern side of Nantha kyun should pass within 3 miles of it, to ensure clearing the shoals eastward of it.

Currents.—The currents in the vicinity of these shoals are influenced by the monsoon, but it has been observed that they are also affected by the tides, both in strength and direction; they set strongly across the shoals.

Bluff cape to Gwa bay.—Coast.—From Bluff cape the coast trends south-south-eastward for about 23 miles to the northern entrance point of Gwa bay. Close within this stretch of coast are several peaks which may be easily identified from seaward; of these, High peak, 1,920 feet (585^m2) high, situated about 12 miles south-south-eastward of Bluff cape; Taunglun taung (Quoin hill), 830 feet (252^m9) high, about 15 miles south-south-eastward of Bluff cape; and Button hill, 409 feet (124^m7) high, about 3 miles southward of Taunglun taung,

Chart 3771.

are all prominent. Toungnela, 3,760 feet (1146^m1) high, about 12½ miles eastward of Bluff cape, and Kungyaung taung (South Sharp peak), 2,320 feet (707^m1) high, about 4½ miles eastward of High peak, are also easily distinguished from seaward.

The only village of any importance on this stretch of coast is Satthwa (Hswathwa), about 13½ miles south-south-eastward of Bluff cape; the village is situated on the southern bank of Satthwa chaung (Hswathwa river) close within the mouth, which is narrow, obstructed by a shallow bar and can only be approached through a narrow inshore channel which leads from southward through reefs and shoals.

Off-lying dangers and banks.—Caution.—In 1935, considerably shoaler depths than are shown on the chart were reported in a position about 5 miles south-south-westward of Bluff cape. Numerous dangers lie in depths of less than 10 fathoms (18^m3) between Bluff cape and the entrance to Satthwa chaung (*Lat.* 17° 47' N., *Long.* 94° 30' E.), the outermost being a shoal patch which dries 2 feet (0^m6), lying about 6 miles west-north-westward of High peak and about 2 miles offshore. Foul ground, on which are numerous drying rocks, extends about 2½ miles south-westward of the entrance to Satthwa chaung, and a 5-fathom (9^m1) detached patch lies about three-quarters of a mile westward of the extremity of this foul ground.

Thyne bank, with a least depth of 15 fathoms (27^m4), coral, lies about 12½ miles westward of Taunglun taung; White bank, with a least depth of 12 fathoms (21^m9), coral, lies about 8½ miles west-south-westward of the same hill.

Gwa bay.—Anchorage.—Gwa bay is entered between a point situated about 5 miles southward of Button hill, and another point about 2 miles farther southward; the latter point is the extremity of a promontory extending northward which forms the western side of Gwa chaung. The northern entrance point of the bay is fronted by a reef which extends about three-quarters of a mile south-south-westward from its southern extremity.

Gwa bay affords anchorage, in depths of from 4 to 6 fathoms (7^m3 to 11^m0), but is open to westerly winds.

Gwa kyun, 144 feet (43^m9) high, lies about 2½ miles south-westward of the southern entrance point of Gwa bay, and the islet forms an excellent landmark. It is surrounded by foul ground which obstructs the channel between it and the mainland, which is only navigable by boats with local knowledge. A detached rock, which dries 5 feet (1^m5), lies about 1½ miles north-north-eastward of Gwa kyun and about the same distance westward of the southern entrance point of Gwa bay.

The entrance to Gwa chaung lies about three-quarters of a mile east-south-eastward of the southern entrance point of Gwa bay; the mouth of the river is fronted by a bar of sand, over which there is a least depth of 7 feet (2^m1). The village of Gwa stands amongst trees on Cocoonut point, the eastern entrance point of the river; there is a hospital in the village.

There is occasional sea communication with Satthwa, Kyeintali, and Sandoway during the North-east monsoon period.

Charts 3771, 3772.

Gwa bay to Cape Negrais.—Caution.—The depths off the coast between Gwa bay and Cape Negrais, about 95 miles south-south-westward, are very irregular, with numerous off-lying rocks and dangers.

Charts 3771, 3772.

It is not advisable to navigate off this stretch of coast in depths of less than 20 or 25 fathoms (36^m6 or 45^m7).

Chart 3771.

- 5 **Gwa bay to Tazin-hmaw. — Coast. — Off-lying dangers. — Anchorage.**—Between the southern entrance point of Gwa bay and Tazin-hmaw (Broken point), about 42 miles south-south-westward, the coast is rocky and indented by several small bays which, although affording anchorage in fine weather, give little shelter during the South-

10 west monsoon.

Bawmi (Bomie) bay is entered about 16 miles southward of the southern entrance point of Gwa bay. Bawmi chaung (Bomie river), which is navigable by boats, flows into the head of Bawmi bay.

- 15 St. John's or Church rocks (*Lat. 17° 27' N., Long. 94° 20' E.*) consist of four rocks, situated about 13 miles south-westward of Gwa kyun and about 15 miles west-north-westward of the entrance to Bawmi bay. The largest rock, which is 40 feet (12^m2) high, resembles a church when seen from north-eastward. The rocks are steep-to at their northern end but shoals extend about 6 cables southward from

20 them.

- Danson bay is entered about 8 miles south-south-westward of the entrance to Bawmi bay, and is the most sheltered anchorage on the coast between Cheduba strait and Cape Negrais. Foul ground, on which are numerous rocks, extends about 3½ miles westward from the

- 25 south-western entrance point of the bay; West Sandy islet, 15 feet (4^m6) high, lies on this foul ground about 1½ miles westward of the south-western entrance point.

Htan daung (Round hill), 637 feet (194^m2) high, and Ahtugyi taung (Thumb hill), 780 feet (237^m7) high, situated about 2½ miles east-

30 north-eastward, and 3¾ miles east-south-eastward, respectively, of the north-eastern entrance point of Danson bay, are prominent and, from seaward, form excellent marks.

- Anchorage for large vessels, sheltered except from north-westward, may be obtained in Danson bay, in depths of from 5 to 6 fathoms

35 (9^m1 to 11^m0), with Htan daung bearing 056° and Ahtugyi taung bearing 098°. When entering the bay, a wide berth should be given to West Sandy islet.

Chaungtha kyun (High island), 130 feet (39^m6) high, is situated

40 close off the mouth of Chaungtha chaung (Kyaungtha river), about 14 miles southward of West Sandy islet, and about 3 miles north-

eastward of Tazin-hmaw. Thēbyu kyun (Sandy island), 64 feet (19^m5) high, lies about one mile north-north-westward of Chaungtha

kyun, and rocks and foul ground extend about 2½ miles farther north-

westward. The large village of Chaungtha (Kyaung-tha) stands on

45 the north-eastern entrance point of the river. Chaungtha chaung is

navigable by boats and is the nearest point on this coast to the town

of Bassein (page 370). Boats entering the river must pass northward

of Chaungtha kyun, and care should be exercised when landing as there

are several reefs off the entrance and, except in fine weather, a heavy

50 swell breaks on the bar.

Charts 3771, 3772.

Tazin-hmaw to Goyangyi kyun. — Caution. — Off-lying islands and dangers.—Between Tazin-hmaw and Goyangyi kyun

(Korong island), about 24 miles south-south-westward, the coast is

Charts 3771, 3772.

rocky and indented and there are several islands and reefs within a distance of 3 miles of the coast. See caution on page 295.

Hnget-taung kyun (Calventuras) consist of two groups of rocky islets and rocks; North-west group, composed of large rocks, the highest of which is 125 feet (38^{m1}) high, is situated about 10 miles westward of Tazin-hmaw. The south-eastern group consists of North island, 130 feet (39^{m6}) high, situated about 6½ miles west-south-westward of Tazin-hmaw, and South island, 80 feet (24^{m4}) high, about 2½ miles southward of North island. There are two large rocks close northward of South island, and several shoals and a rock which dries 7 feet (2^{m1}), lie between North and South islands. There is a navigable channel between North-west group and North island, and also between the south-eastern group and the mainland, but passage between North and South islands should not be attempted. The summits of the islets and large rocks are wooded and form good marks.

Chart 3772.

About 6 miles southward of Tazin-hmaw is Bugwe kyun (Chaung-gwi) (Lat. 16° 49' N., Long. 94° 24' E.), an islet, 110 feet (33^{m5}) high, which lies close inshore.

The large village of Sinma stands on the northern side of the entrance to Sinma chaung (Thitpok river), about 11 miles southward of Tazin-hmaw. Sinma kyungyi (Round island), 130 feet (39^{m6}) high, lies about three-quarters of a mile northward of the entrance and about half a mile offshore. Sinma chaung is navigable for boats but the bar should only be crossed at high water. When entering the river, boats should avoid Mary rock, a rock awash, about 4 cables west-south-westward of Sinma Kyungyi, by passing northward and eastward of the latter island.

Vibart shoal, which has a least depth of 2½ fathoms (4^{m6}), sand and rock, lies about 2¾ miles south-westward of Sinma kyungyi and about 2 miles offshore.

Migyaunggaung (Alligator head) is the southern extremity of a large rocky promontory about 9 miles south-south-westward of the entrance to Sinma chaung; when seen from seaward, it has the appearance of an alligator's head, facing southward. Kanyin (Nga-Yot) taung, 1,317 feet (401^{m4}) high and one of the most prominent peaks on this coast, rises about 6½ miles south-eastward of Migyaunggaung.

Gahti kyauk (Milestone rock), is a solitary rock, 40 feet (12^{m2}) high and steep-to, about 4½ miles north-north-westward of Migyaunggaung. Thēbu kyun (Little Quoin island), 130 feet (39^{m6}) high, lies about 2¾ miles east-south-eastward of Gahti kyauk and about 1½ miles offshore.

Myingyi kyun (High island) lies about 1½ miles north-westward of Migyaunggaung. North, West and South reefs lie from about three-quarters of a mile to one mile northward, westward and southward, respectively, of Myingyi kyun. Migyaunggaung kyun (Saba island) lies about a quarter of a mile westward of Migyaunggaung and about one mile eastward of South reef.

Ngayok (Nga Yot) bay is entered between Migyaunggaung and the northern end of Goyangyi kyun, about 5 miles south-westward but, except from southward, the bay affords little protection and contains many dangers, the positions of which may best be seen on the chart; it should not be entered by large vessels. Taikthonlon (Saba rocks)

Chart 3772.

are situated in the southern part of the bay, about $2\frac{3}{4}$ miles east-north-eastward of the south-western entrance point. Ngayokkaung (Nga-yot) chaung flows into the south-western corner of the head of the bay about 2 miles southward of Taikthonlon, and is navigable by boats.

Goyangyi kyun (Koronge island), 265 feet (80^m8) high, is rocky, wedge-shaped and of rugged appearance; its eastern side is precipitous. North rock, a large detached rock, lies close off the northern end.

The channel between Goyangyi kyun and the mainland is encumbered with reefs and foul ground; it is only navigable by boats, and they should keep close to the western shore when passing through it.

Anchorage.—Good anchorage, sheltered from northward and north-westward, may be obtained in depths of about 6 fathoms (11^m0), sand, between the southern end of Goyangyi kyun and the mainland, but, when approaching the anchorage, care is necessary to avoid Crawford shoal (*Lat.* 16° 29' N., *Long.* 94° 12' E.) *see* below, and a rock which dries 2 feet (0^m6), situated about $1\frac{1}{2}$ miles south-eastward of the southern end of Goyangyi kyun.

Charts 3772, 834.

Goyangyi kyun to Cape Negrais.—Coast.—From abreast Goyangyi kyun, the coast trends southward for about 29 miles to Cape Negrais and is rocky and indented. Round cape, about $15\frac{1}{2}$ miles southward of Goyangyi kyun, is a prominent, thickly-wooded point, 340 feet (103^m6) high. Taunggyan taung (Yot-pa) is a prominent conical hill, 736 feet (224^m3) high, situated about 4 miles south-eastward of Round cape, which shows up well from all directions. This hill, Spike hill, 850 feet (259^m1) high, about $9\frac{1}{2}$ miles northward, and Fat hill, 650 feet (198^m1) high, about 7 miles southward of it, are the most easily distinguished summits between Goyangyi kyun and Cape Negrais.

Cape Negrais is a prominent cape with cliffs rising steeply from the sea. The summit of the cape, about half a mile eastward of its extremity, is 410 feet (125^m0) high and forms the end of a spur of the Arakan Yoma range.

Chart 3772.

Off-lying islands, dangers and bank.—*See* caution on page 295. Crawford shoal consists of a group of rocks which dry 4 feet (1^m2), situated about $2\frac{3}{4}$ miles south-westward of the southern point of Goyangyi kyun. There are considerable depths close to the northern side of the shoal, but a spit with a depth of 3 fathoms (5^m5) at its outer end, extends about half a mile southward from it.

Megaunggan kyun (May-gaumbaun), 65 feet (19^m8) high, Ongyun (Ung-Chune), an island, 175 feet (53^m3) high, and Leik kyun (Lichune island), 120 feet (36^m6) high, form a group which is situated from about 6 to 9 miles southward of Goyangyi kyun and about one to 2 miles offshore. Sunken and above-water rocks or shoals surround all these islands, and several shoal heads with depths of $2\frac{3}{4}$ and 3 fathoms (5^m0 and 5^m5) lie about $2\frac{3}{4}$ miles offshore westward of the group.

Saingbain Kieu or the Buffaloes are a group of detached rocks lying from $1\frac{1}{2}$ to 4 miles south-south-westward of Leik kyun and parallel with the coast; they are very prominent, several of them showing white. North Twin, about 6 miles north-north-westward of Round

Chart 3772.

cape, and South rock, about 4 miles north-westward of the same point, are, respectively, the northernmost and southernmost of these rocks; Pillar rock, about half a mile south-south-westward of North Twin, is 43 feet (13^m1) high and is the highest.

There are numerous shoal patches with depths of from 3½ to 5 fathoms (5^m9 to 9^m1), lying between South rock and Round cape, the positions of which can best be seen on the chart. Mushroom rock, 9 feet (2^m7) high, lies about 2 miles northward of Round cape and about one mile offshore.

Charts 834, 3772.

Black rock is a solitary, dark-coloured rock, 4 feet (1^m2) high, lying about 4½ miles south-westward of Round cape and about 2 miles offshore.

A bank with a depth of 10 fathoms (18^m3) over it, and a shoal with a depth of 6½ fathoms (11^m4) over it, lie about 5½ miles west-north-westward, and about 5½ miles westward, respectively, of Cape Negrais.

Cape Negrais to Pagoda point. — Coast. — Off-lying dangers.

Caution.—Between Cape Negrais and Pagoda point, about 6 miles south-south-eastward, the coast consists of a succession of low hills most of them densely wooded; towards Pagoda point some distinctive bare slopes of reddish blown sand show a well-defined edge of dark foliage near their summits. See views A and B on chart 834.

Pagoda point (*Lat. 15° 57' N., Long. 94° 15' E.*) is about 100 feet (30^m5) high and flat; it terminates in a bluff with rather bare sides, the south-western being the steepest. A pagoda, the top of which has an elevation of 144 feet (43^m9), stands on the extremity of the point and is visible above the trees near it.

This stretch of coast is fringed by a reef which extends as much as 6 cables offshore in places, and parts of which dry. Abreast Pagoda point, the reef, which here extends about a quarter of a mile offshore, dries about 4 feet (1^m2), and depths of less than 3 fathoms (5^m5) extend about 5½ cables southward from the point; a small obelisk, 9 feet (2^m7) high, stands on the reef near the south-eastern extremity of Pagoda point.

Several rocks lie outside the reef which fringes the coast between Cape Negrais and Pagoda point, and this stretch of coast should not be approached within a distance of 3 miles, and even outside this distance caution is necessary.

Chart 3772.

Outlying bank and shoal.—Juanita shoal, a coral bank with a least depth of 16 fathoms (29^m3) over it, lies about 30 miles westward of Cape Negrais.

A shoal with a depth of 8 fathoms (14^m6) over it, was reported in 1946 in a position about 22½ miles south-westward of Pagoda point (*Lat. 15° 57' N., Long. 94° 15' E.*).

Charts 834, 3771, 3772.

Current.—Between Gwa bay and Cape Negrais, the current follows the direction of the coast, setting northward or southward with the monsoon, and barely exceeds a rate of one knot.

Charts 823, 829, 830, 70.

CHAPTER VIII

PREPARIS ISLAND AND CHANNELS, AND THE COCO, ANDAMAN AND
NICOBAR ISLANDS*Chart 830.*

ISLANDS IN THE SOUTH-EASTERN PART OF THE BAY OF BENGAL.—General remarks.—A chain of islands, divided into four groups by well-defined channels, stretches in a vast ellipse
 5 between Pagoda point (page 299) and the northern end of Sumatra, about 630 miles southward. The principal channels leading between the groups are :—Preparis North channel, leading between Alguada reef and Preparis island ; Preparis South channel, leading between Preparis island and the northernmost island of the Coco group ; Coco
 10 channel, leading between the southernmost island of the Coco group and the northernmost of the Andaman islands ; and Ten Degrees channel, leading between the southernmost of the Andaman islands and the northernmost of the Nicobar islands.

Charts 823 and 825.

15 **PREPARIS ISLAND AND NORTH AND SOUTH CHANNELS.—Preparis North channel.—Tidal streams.—Currents.**
 —Preparis island is situated about 72 miles south-south-westward of Pagoda point and about 43 miles north-eastward of the Coco group.

Preparis North channel lies between Preparis island and the southern
 20 end of Alguada reef, situated about 56 miles north-westward of Preparis island and about 17 miles southward of Pagoda point. Diamond island and the shoals and dangers lying in the approaches to Bassein river, north-north-eastward of Alguada reef, are described on page 365.

Chart 823.

25 In Preparis North channel the tidal streams appear to set south-eastward with the rising tide and north-westward with the falling tide. During the North-east monsoon there is a south-going current of from one knot to $1\frac{1}{2}$ knots, which at neaps entirely overcomes the north-westerly tidal stream. A north-going stream of from a half to three-
 30 quarters of a knot has been experienced. The south-going stream has a rate of about 2 knots.

Tide-rips are indicated on the chart, about 19 miles westward of Alguada reef.

Chart 834.

35 **Alguada reef.—Light.—Tidal streams.**—A light (Lat. $15^{\circ} 42' N.$, Long. $94^{\circ} 12' E.$) is exhibited, at an elevation of 144 feet (43^m9), from

Charts 830, 70.

Chart 834.

a granite tower, painted in black and white horizontal bands, 160 feet (48^m8) in height, situated near the south-western end of the reef, about 15 miles south-south-westward of Pagoda point. See sketch on charts 834 and 823. 5

Alguada reef dries 7 feet (2^m1). Detached sunken rocks extend for a considerable distance from the reef. Hugh Rose rock, which is awash, lies at the northern end of the reef, about 2½ miles north-north-eastward of the lighthouse. A 2¼-fathom (4^m1) patch lies about 1¼ miles southward of the lighthouse, and depths of 5½ fathoms (10^m1) and less, extend about three-quarters of a mile farther south-westward. A staff is charted about 7 cables north-eastward of the lighthouse. 10

At Alguada reef the tidal streams are much influenced by the winds, especially at neaps; the stream usually sets south-eastward with the rising tide and north-westward with the falling tide. During the North-east monsoon, at springs, the north-west-going stream begins about 2 hours after high water, and runs until low water, at a rate of from one to 2 knots, the period of slack water being very short. 15

Charts 823, 825.

Preparis island.—Outlying shoal.—Islets and dangers.—20
Preparis island, a narrow and wooded island about 4½ miles long in a north-north-easterly and south-south-westerly direction, is 265 feet (80^m8) high and slopes gradually to the sea. In 1887, the island was uninhabited; numerous monkeys and some turtle were then seen. Good fishing can be obtained in the vicinity of the island. 25

Chart 823.

Thalia shoal, over which there is a depth of 10 fathoms (18^m3), coral, is situated about 22 miles north-north-eastward of the northern end of Preparis island; the depths in the vicinity of this shoal are irregular and the bottom is mostly grey sand and coral. 30

Charts 823, 825.

Preparis island is fringed by a reef which extends about 3½ miles southward from its southern end, with numerous rocks, both above-water and sunken, on it.

Cow and Calf islets are three flat-topped islets which lie close together about 1½ miles northward of Preparis island with considerable depths in the narrow channel between. 35

An extensive reef on which there are some islets, the largest of which is 92 feet (28^m0) high, lies about 1¼ miles westward of Preparis island with considerable depths in the channel between. 40

A coral reef on which there is a pinnacle rock 40 feet (12^m2) high, lies about 4 miles south-westward of the southern end of Preparis island (*Lat.* 14° 50' N., *Long.* 93° 37' E.); about half a mile southward of the southern end of this reef, is another reef, on which is a small rock, 6 feet (1^m8) high. 45

Several coral heads with depths of from 1¼ to 2 fathoms (2^m3 to 3^m7) over them, lie within 1¼ miles of the south-eastern side of Preparis island; a rock, awash, lies about three-quarters of a mile southward of the northern end of the island and about a quarter of a mile off the eastern coast. A pinnacle rock over which there is a depth of 1½ fathoms (2^m7), lies about 1½ miles eastward of the northern end of the island. 50

Anchorage.—During the South-west monsoon there is anchorage off the eastern coast of Preparis island, in depths of from 12 to 14 fathoms (21^m9 to 25^m6). 55

Charts 830, 70.

Charts 823, 825.

During the North-east monsoon, anchorage may be obtained off the western side of the island.

In March, 1931, H.M.S. *Effingham* anchored with the southern end of the island bearing 080°, distant one mile. Although the weather was calm there was a slight swell, and landing on the rocky coast required care.

Landing can be effected on the eastern side of Preparis island, south-eastward of its highest part, between two ledges of rock close to a sandy beach.

Chart 825 and plan of Table island and Marshal channel.

Preparis South channel.—Light.—Caution.—Preparis South channel lies between Preparis island and Table island, the northernmost island of the Coco group, about $4\frac{1}{2}$ miles south-south-westward. Table Island light is exhibited, at an elevation of 195 feet (59^m4), from a circular steel tower, painted in red and white bands, 91 feet (27^m7) in height, situated on the south-western and highest part of Table island.

Besides the irregularity of soundings in the vicinity of Table island, the tidal streams in this locality are strong and often set on to the rocks; vessels should therefore keep well northward of Table island.

Preparis South channel is dangerous to submarines diving, owing to the uncertainty that mines may still exist.

Chart 3103.

COCO ISLANDS AND CHANNEL.—The Coco group of islands consists of Table island, Great Coco island, about $1\frac{1}{2}$ miles southward and separated from Table island by Marshall channel, and Little Coco island, about $8\frac{3}{4}$ miles west-south-westward of Great Coco island and separated from it by Alexandra channel.

Chart 825, plan of Table island and Marshall channel.

Table island.—Light.—Anchorages.—Table island, which, except on its south-western side, is densely wooded, presents a flat, level surface with steep sides on all bearings. See view on chart 825.

Table Island lighthouse is described above.

Slipper island (*Lat.* 14° 11' N., *Long.* 93° 22' E.), about 2 cables north-westward of the north-western extremity of Table island and connected with it by a drying reef, is covered with grass and has a few trees near its summit; a remarkable pillar rock is situated near its western extremity. A stepping-stone causeway, passable at half-tide, extends across the drying reef between the eastern point of Slipper island and Table island.

Numerous rocks and shoals, the positions of which may best be seen on the chart, lie off Table island in depths of less than 10 fathoms (18^m3). A detached $6\frac{1}{2}$ -fathom (11^m9) patch lies about $1\frac{1}{4}$ miles north-eastward of the island, and irregular depths which cause tide rips, extend about $4\frac{1}{2}$ miles north-eastward of the island. See also caution above.

There are some small deer on Table island.

During the North-east monsoon anchorage may be obtained in Table bay on the south-western side of the island, in a depth of about 10 fathoms (18^m3) rock, with the lighthouse bearing 012°, about 3 cables offshore; when anchoring, care is necessary neither to be too close to the reef, nor so far out as to experience the strength of the tidal streams.

Charts 825, 830, 70.

Chart 825, plan of Table island and Marshall channel.

In Table bay, there is a small stone jetty about 50 feet (15^m2) in length, close southward of the lighthouse. The approach to the jetty is marked by a white square board in line with the eastern white-washed gate of the lighthouse fence. When swell makes landing at the jetty impossible, landing on the beach immediately south-eastward of it can be effected about the time of high water. 5

During the South-west monsoon anchorage may be obtained off the northern side of Table island, in depths of from 9 to 12 fathoms (16^m5 to 21^m9), sand and rock, with the lighthouse bearing 180°, about 10 4 cables offshore, but this position is exposed.

The landing place on the northern side of the island is approached by a channel, 300 feet (91^m4) wide at its outer end, and about 150 feet (45^m7) wide near the beach; it is marked by two or three iron stakes situated on the reef on either side of the channel. This landing place 15 is well sheltered in southerly weather.

Climatic table.—See page 80.

Marshall channel.—Marshall channel separates Table island from the northern point of Great Coco island, about 1½ miles southward. There are depths of from 5½ to 9 fathoms (9^m6 to 16^m5) in the fairway 20 which lies in mid-channel and is about half a mile wide, but the tidal streams set very strongly in Marshall channel and there are heavy tide races, see page 304.

Charts 825, plan of Table island and Marshall channel, 3103.

Great Coco island.—**Anchorage.**—Great Coco island is about 25 5½ miles long in a north and south direction. On its western side it rises very steeply from the sea and there are a few bare patches, while it slopes gradually to the sea and is densely wooded on its eastern side. A belt of coconut palms fringes the coasts of the island.

There are no off-lying dangers, but rocky and foul ground extends 30 about 2½ cables from its northern point and about 3½ cables from its north-western point.

Pollok bay lies between the northern extremity of the island and Pechee point (*Lat. 14° 09' N., Long. 93° 23' E.*), about one mile south-eastward. Pechee point is a bluff, 150 feet (45^m7) high, surmounted 35 by a few trees and connected with the mainland by a low neck on which is a small freshwater lagoon; a coconut plantation extends on either side of the root of the low neck of land. Pollok bay is nearly filled by a reef on the outer edge of which is Binnacle rock, about 14 feet (4^m3) high. 40

Ford bay is entered between Pechee point and Rat island, a wooded islet, 125 feet (38^m1) high, about one mile southward; reefs extend about 2 cables eastward from the islet, and others connect it with the main island westward.

During strong westerly winds good sheltered anchorage may be 45 obtained in Ford bay, about 6½ cables northward of Rat island, in depths of from 7 to 10 fathoms (12^m8 to 18^m3), sand and mud.

Jerry island, an islet 97 feet (29^m6) high, lies on a reef which extends about one mile southward from the southern extremity of Great Coco island. Rocky ground with irregular depths extends about 2 miles 50 southward of Jerry island, and vessels should give a berth of 3 miles to the southern end of this islet.

Chart 3103.

Little Coco island.—**Dangers.**—Little Coco island, about 2½ miles

Charts 825, 830, 70.

Chart 3103.

long in a north and south direction, lies with its northern end about $8\frac{1}{2}$ miles west-south-westward of Jerry island; the island is densely wooded and its coasts are lined by a belt of coconut palms. There are a few wild pigs on the island and near the south-western point is a small freshwater lagoon.

There are considerable depths in Alexandra channel, the passage separating Great and Little Coco islands.

Little Coco island is fringed by a coral reef which extends only a short distance from its eastern and western sides, but extends about half a mile from its northern end and a similar distance from the south-western point of the island.

Irregular depths extend about $1\frac{3}{4}$ miles northward from the northern end, and foul, uneven ground extends about 4 miles southward from the southern end of the island.

Investigator patch, over which there is a least depth of $1\frac{1}{2}$ fathoms (2^m7), is a detached shoal area of rocky ground, situated about 2 miles east-south-eastward of the southern extremity of Little Coco island.

There are rocks awash in places on the foul ground extending about 4 miles southward from the southern extremity of Little Coco island; Middle rock, with a depth of less than 6 feet (1^m8) over it, lies about 2 miles southward of the southern point of Little Coco island; Daphne rock, a small $2\frac{3}{4}$ -fathom (5^m0) coral patch, lies about half a mile southward of Middle rock, and South patch is situated about $1\frac{1}{2}$ miles south-south-eastward of Daphne rock (*Lat.* $13^\circ 56' N.$, *Long.* $93^\circ 14' E.$). The least known depth over South patch is 7 fathoms (12^m8), but there may be less.

Anchorage.—During easterly winds, there is good sheltered anchorage, in depths of from 9 to 12 fathoms (16^m5 to 21^m9), sand and mud, in Lambert bay on the western side of the island. The depths there shoal gradually; on the eastern side of the island the bottom is rocky and foul.

Tidal streams.—In the vicinity of the Coco group, the tidal stream runs eastward with the rising tide and westward with the falling tide; in settled weather the streams appear to turn at high and low water. The rate of the tidal streams is upwards of 5 knots in Marshall channel, and about 2 knots past the northern and southern ends of Little Coco island.

Even in fine weather there are heavy tide races off all the salient points, especially off the north-western point of Slipper island, north-eastward of Table island, southward of Jerry islet, in Marshall channel and at both ends of Little Coco island.

Coco channel.—**Caution.**—Coco channel, which separates the Coco and Andaman islands, is deep; it lies between Little Coco island and Landfall island, the northernmost of the Andaman islands, situated about $21\frac{1}{2}$ miles south-south-westward.

In the southern part of Coco channel the depths are irregular and the bottom is coral with occasional patches of sand and mud. A 10-fathom (18^m3) patch lies about $10\frac{1}{4}$ miles east-north-eastward of the northern extremity of Landfall island and, in bad weather, the strong tidal streams cause a heavy sea over this shoal.

The southern end of Little Coco island should not be approached within a distance of 5 miles and the northern end of Landfall island, within a distance of 4 miles.

Charts 825, 830, 70.

Chart 3103.

Tidal streams.—Currents.—During settled weather the tidal streams in Coco channel are regular, the stream setting eastward with the rising tide and westward with the falling tide, at rates of from one to 2 knots at springs. 5

The streams are much influenced, and frequently even reversed, by strong winds.

Tide-rips occur in the vicinity of all shoal water in Coco channel.

During the North-east monsoon the current frequently sets north-westward through Coco channel, but during the South-west monsoon 10 its direction is mostly eastward.

Chart 825.

ANDAMAN ISLANDS.—General remarks.—The Andaman islands, which extend for about 200 miles in a north and south direction, are reported to consist of about 200 islands and islets. The main 15 part of the group is a block of five islands close to each other and overlapping, namely, North Andaman, Middle Andaman, Baratang, South Andaman and Rutland island.

Off the western coast of the Andaman islands there are coral reefs which are more extensive, and lie at a far greater distance from the 20 coast, than those off the eastern coast, shoal patches being found at a distance of as much as 21 miles from the land. The highest parts of the Andamans, which consist of hills covered with luxuriant vegetation, are on the eastern side, and slope gradually towards the western side, where marshy localities abound. 25

The western side of the islands is exposed to the South-west monsoon, in which season, especially, it should not be approached; at no time is it by any means a desirable locality.

The islands of the Andaman group are described below from north to south in the following order:—Landfall island; Western side of the 30 main block of islands; eastern side of the main block of islands; islands and passages at the southern end of the main block; and the outlying islands eastward of the main block.

For further general remarks on the Andaman islands, *see* page 21.

Currents.—For the set of the current on either side of the islands, 35 *see* pages 24 and 25.

Off-lying banks and dangers.—West Coral, Middle and South banks are three banks, composed of dead coral and sand, with some patches of live coral, off the western side of the Andaman islands; the water over these banks is very clear and, judging from the appear- 40 ance of the bottom, it seems probable that rollers break on Middle bank during the South-west monsoon, though they may not do so on the other banks.

Depths of 100 fathoms (182^m9) are found close westward of these banks, and the increase of swell usually indicates their vicinity. 45

During the North-east monsoon the banks may be passed over safely, but vessels of deep draught should not cross the shoaler parts. The navigation inside the banks to within about 3 miles of the land, is safe, except on the western side of North Andaman island, to which 50 a berth of 6 miles should be given.

West Coral bank, the northernmost of these banks, the outer edge of which lies from 15 to 23 miles westward of North Andaman island, has a least depth of 6 fathoms (11^m0), rock, situated about 19 miles

Charts 830, 70.

Chart 825.

westward of the coast of North Andaman island, and about 40 miles south-westward of the northern extremity of Landfall island (*Lat.* 13° 40' N., *Long.* 93° 02' E.).

- 5 Middle bank, the shoalest part of which lies about 17 miles westward of Middle Andaman island and about 44 miles southward of the shoalest part of West Coral bank, has a least depth of 3½ fathoms (6^m9), rock. South bank has a least depth of 6 fathoms (11^m0) near the centre, which is situated about 14 miles southward of the shoalest part of Middle bank, and about 16 miles westward of the western side of Spike island (page 311).

Chart 3103.

- LANDFALL ISLAND AND CLEUGH PASSAGE.—Off-lying dangers.**—Landfall island is fringed by a reef which extends as much as half a mile offshore in places. Landfall rocks, lying on the reef close off the south-eastern end of the island, are 42 feet (12^m8) high and are prominent.

- East island, about three-quarters of a mile eastward of Landfall island, is separated from the latter island by a channel with a least depth of 3 fathoms (5^m5) in the fairway, but so narrow as to be only suitable for boats. Channel islet, a large rock, 96 feet (29^m3) high, lies about 3½ cables off the eastern side of Landfall island and close to the reef which fringes that island. The small Andamanese pig abounds on East island.

- 25 Hickman shoal, about 1¼ miles northward of the north-western extremity of Landfall island, consists of two patches, of which the southern has a least depth of 4½ fathoms (8^m2) over it, and the northern a least depth of 4½ fathoms (8^m7).

- Between Hickman shoal and Landfall island, and eastward of the shoal, are several patches with depths of from 2½ to 5½ fathoms (5^m0 to 10^m1); shoals with depths of less than 5 fathoms (9^m1) lie within 2 miles north-westward of the northern end of East island.

- Ranger reef, with a least depth of one fathom (1^m8) over it, lies about 2 miles eastward of the northern end of East island; two 5-fathom (9^m1) patches lie about half a mile and three-quarters of a mile, respectively, northward of Ranger reef. The sea breaks on the reef in heavy weather, but at other times it cannot be seen, even from aloft; tide-rips occur in its vicinity, and between it and the northern point of East island.

- 40 Jackson ledge, over which there is a least depth of 1½ fathoms (3^m2), lies about 3½ miles eastward of the north-eastern point of East island; tide-rips occur in its vicinity, but it has not been seen to break.

- Cleugh passage.—Island and dangers.**—Cleugh passage separates Landfall and East islands from North Andaman island, about 3 miles southward; it is a navigable channel but, owing to the numerous shoals in it for which there are no clearing marks, and the strong tidal streams, passage through it is not recommended.

- Cleugh rocks, about 1½ miles south-south-westward of the south-western point of Landfall island, consist of a reef, the western part of which dries about 8 feet (2^m4). Passage rock, situated about half a mile south-eastward of Cleugh rocks and nearly in the middle of Cleugh passage, dries about 4 feet (1^m2) and is steep-to.

Charts 825, 830, 70.

Chart 3103.

The passage northward of Cleugh rocks or between them and Passage rock, should not be attempted.

Cape Price, the northernmost extremity of North Andaman island, situated about $2\frac{3}{4}$ miles southward of Landfall rocks, is densely wooded and slopes gradually to the sea. Between Cape Price and Cape Thornhill, about 7 miles west-south-westward, the southern shore of Cleugh passage is indented, densely wooded, and generally fringed with mangroves.

One-Fathom patch, with a depth of about 6 feet (1^m8) over it, lies about 6 cables northward of Cape Price (*Lat.* $13^\circ 35' N.$, *Long.* $93^\circ 02' E.$) and the sea breaks on it in heavy weather. There are depths of from $3\frac{1}{2}$ to $6\frac{1}{2}$ fathoms (6^m4 to 11^m9) between One-fathom patch and Cape Price, and a $2\frac{3}{4}$ -fathom (5^m0) patch lies about half a mile westward of the cape.

Wedge rock, about $1\frac{1}{2}$ miles west-north-westward of Cape Price and about one mile off the southern shore of Cleugh passage, is about 6 feet (1^m8) high and is fringed by a drying reef. A $2\frac{1}{2}$ -fathom (4^m6) patch, surrounded by depths of from 4 to 5 fathoms (7^m3 to 9^m1), lies about one mile westward of Wedge rock, and a rock, 3 feet (0^m9) high, with depths of less than 5 fathoms (9^m1) around it, lies about half a mile southward of the $2\frac{1}{2}$ -fathom (4^m6) patch and about $3\frac{1}{2}$ cables offshore.

West island, 178 feet (54^m3) high and thickly wooded, is situated in the western approach to Cleugh passage, about $3\frac{1}{2}$ miles north-north-westward of Cape Thornhill. It is fringed with reef, and depths of less than 5 fathoms (9^m1) extend between a quarter and half a mile offshore; a detached $4\frac{1}{2}$ -fathom (8^m7) patch lies about half a mile southward of the southern end of West island.

Tidal streams.—In Cleugh passage the tidal stream sets about east-south-eastward with the rising tide and west-north-westward with the falling tide, the rate at springs being about $1\frac{1}{2}$ knots. Tide rips occur over almost the whole of the passage.

*Charts 3103, 825.***WESTERN SIDE OF NORTH ANDAMAN ISLAND.—Aspect.**

—Commencing from the northern end, the summits in North Andaman island which make the best marks, are :—Taylor hill, 644 feet (196^m3) high, a long ill-defined summit, about $6\frac{1}{2}$ miles south-south-eastward of Cape Thornhill (chart 3103), the north-western point of the island; Doyly (D'Oyley) hill, 522 feet (159^m1) high and pointed, about 8 miles southward of Cape Thornhill; Tasou (Tuson) hill, 790 feet (240^m8) high, having three summits of nearly equal height and with only a slight dip between them, situated about $6\frac{1}{2}$ miles south-south-westward of Doyly hill; Tadikelly (Tradikeli) hill, 1,110 feet (338^m3) high, a sharp ridge with a peak at its southern end, situated about 8 miles southward of Doyly hill; North Saddle peak (Saddle N. peak), 2,247 feet (684^m9) high, having a flat top with a sharp peak at its northern end, about 23 miles southward of Cape Price, the northern point of the island; Saddle hill, 2,402 feet (732^m1) high, a rounded summit about $2\frac{3}{4}$ miles southward of North Saddle peak. On easterly and westerly bearings the two latter mountains form two peaks with the appearance of a saddle; they are covered with vegetation.

The following hills near the west coast of the island also form good

Charts 830, 70.

Charts 3103, 825.

marks : Brown's hill, 300 feet (91^m4) high, about one mile south-eastward of Cape Thornhill ; Jessop hill, 440 feet (134^m1) high, situated on a point at the head of Hudson bay, about 15 miles south-south-
 5 westward of Cape Thornhill ; and Lowis hill, 360 feet (109^m7) high, situated near the coast on a peninsula separating Hudson and Casuarina bays and about 1½ miles southward of Jessop hill ; all these hills have two summits. Bluff point, 230 feet (70^m1) high, with an irregular summit, situated about 4½ miles south-westward of Cape Thornhill, is
 10 also noticeable.

Chart 3103.

Cape Thornhill to Shearme island.—Coast.—Off-lying islands and dangers.—From Cape Thornhill (*Lat. 13° 32' N., Long. 92° 56' E.*), the coast, which is much indented and lined with mangroves, trends
 15 south-westward for about 4½ miles to Bluff point, and then southward for about 4 miles to Shearme island, which is separated from the coast of North Andaman island by a narrow channel. Bluff point is cliffy and bold, and presents three summits when viewed from south-south-westward. De Berry rocks, about three-quarters of a mile south-
 20 westward of Bluff point, are about one foot (0^m3) high.

Between West island and the northern end of North Andaman island are several patches with depths of less than 5 fathoms (9^m1) over them ; the south-easternmost of these patches has a least depth of 4 fathoms (7^m3), and lies about 3 miles east-south-eastward of the northern point
 25 of West island and about 2½ miles off the northern coast of North Andaman island.

Although the shoals off the northern end of the Andaman islands have been examined, there is a possibility that less depths than are charted may exist over them and, as these shoals are not always visible
 30 from aloft, vessels should not attempt to pass over any shoal charted in this vicinity.

Thornhill island, 254 feet (77^m4) high, is separated from Cape Thornhill by a narrow channel in which there is a least depth of 2½ fathoms (4^m1). A reef with rocks 3 feet (0^m9) high on it, lies about 2½ cables
 35 north-eastward of Thornhill island and about a similar distance from the coast of the mainland.

White Cliff island, 110 feet (33^m5) high, lies about 1½ miles westward of Thornhill island with considerable depths in the fairway of the channel between them ; except at its northern end, where it is steep-to
 40 and backed by cliffs, 66 feet (20^m1) high, it is fringed by reef.

Reef island, about 1½ miles southward of White Cliff island, is low and covered with trees, the tops of which are about 140 feet (42^m9) high. Except on its eastern side which is steep-to, the island is fringed by reef. A bank on which the depths are less than 3 fathoms (5^m5),
 45 extends about 9 cables west-south-westward from the south-western point of the island, and irregular depths of less than 10 fathoms (18^m3), rock, extend about 1½ miles farther west-south-westward.

Chart 3190.

Temple sound.—Dangers.—Temple sound lies between Shearme island on the east, and Paget and Point islands on the north and west. Shearme island is 190 feet (57^m9) high and, except in the narrow channel separating it from the mainland eastward, is fringed by a drying reef. Oldham rocks, 10 feet (8^m0) high, lie about 4 cables north-north-eastward of the north-western point of Shearme island ;

Charts 825, 830, 70.

Chart 3190.

Sugarloaf island, a prominent conical rock, 65 feet (19^m8) high, lies about 1½ miles south-south-westward of the south-western point of Shearme island and on the south-eastern side of the entrance to the sound.

Paget island, about 8½ cables north-westward of the north-western point of Shearme island, is 250 feet (76^m2) high to the tops of the trees and, except on part of its eastern side, is fringed by a drying reef which extends as much as 4 cables northward from its north-eastern point; a spit on which the depths are less than 3 fathoms (5^m5), extends about 8 cables northward from the latter point. Cliffs about 100 feet (30^m5) high, line the south-eastern side of Paget island.

Point island (*Lat.* 13° 24' N., *Long.* 92° 50' E.), about 4 cables south-westward of Paget island, is covered with trees, the tops of which are about 150 feet (45^m7) high. It is almost surrounded by a drying reef on which mangroves grow round the southern and eastern sides; the reef extends about three-quarters of a mile from the northern point of the island and about 3 cables from its south-western side. There is a least depth of 3½ fathoms (6^m4) in the fairway of the channel separating Paget and Point islands; this channel is about 1½ cables wide.

In the northern approach to Temple sound, between Paget island on the west, and the coast between Bluff point and Shearme island, on the east, there are several shoals, the positions of which may best be seen on the chart.

In the southern approach, Bolton shoal, which lies nearly in mid-channel between the southern end of Point island, and Sugarloaf island, about 2½ miles south-south-eastward, has a least depth of 5 fathoms (9^m1) over it.

A bank on which the depths are less than 10 fathoms (18^m3), extends about 9 cables south-south-eastward from the southern end of Point island, and nearly joins Bolton shoal.

Anchorage.—Caution.—Good anchorage, sheltered from all except south-westerly winds, may be obtained in depths of from 10 to 12 fathoms (18^m3 to 21^m9), mud and sand, in the centre of the sound, about half a mile southward of Paget island and midway between Shearme and Point islands. Anchorage for small vessels is indicated on the chart about one mile farther east-north-eastward, in depths of about 8 fathoms (14^m6), about 2½ cables westward of Oldham rocks.

The depths in Temple sound are very irregular, and caution is necessary both when entering and when anchoring; the chart is the best guide.

Chart 825.

Shearme island to Austen strait entrance.—Coast.—From Point Stuart, situated about one mile southward of the south-western point of Shearme island, the coast trends southward for about 29 miles to the western entrance to Austen strait. This stretch of coast is much indented and is fronted by numerous islands, rocks and shoals, the outermost of which are described below, while the positions of the remainder may best be seen on the chart.

Reef inlet, the southern entrance to the narrow channel separating Shearme island from the mainland, is entered between the south-western point of Shearme island, and Point Stuart, about one mile southward.

Hudson bay, entered about 5 miles southward of Point Stuart, and

Chart 825.

Casuarina bay, entered about 3 miles farther southward, are both shallow and completely open westward.

Off-lying islands and dangers.—Anchorage.—Mackey bank, 5 with a least depth of 4 fathoms (7^m3), lies about 5½ miles west-south-westward of Sugarloaf island; vessels should pass outside this shoal.

Snark (Shark) island (*Lat.* 13° 12' N., *Long.* 92° 46' E.), about 10½ miles south-south-westward of Sugarloaf island and about 3½ miles offshore, is a sandy islet covered with bushes about 20 feet (6^m1) high, 10 and surrounded by a coral reef which extends about one cable offshore and on which are some above-water rocks; vessels should pass outside this islet.

North Reef island is low, flat, wooded and marshy; it lies about 6½ miles south-south-westward of Snark island and about 4 miles 15 offshore. A reef extends about 2 miles southward from the southern point of the island.

Latouche island, a wooded sandstone islet, lying close off the north-eastern part of North Reef island, is separated from that island by a narrow channel which is further narrowed by a spit.

20 Vessels with local knowledge may obtain good anchorage in the position indicated on the chart, about 1¾ miles eastward of North Reef island, in depths of from 6½ to 9 fathoms (11^m9 to 16^m5); care must be taken to avoid a 3-fathom (5^m5) patch which lies about 1½ miles east-north-eastward of the southern point of North Reef island. When 25 approaching the anchorage from north-westward, vessels should round Latouche island at a distance of about 4 cables, in order to avoid a 3½-fathom (6^m4) shoal which lies about 1½ miles northward of that islet.

The northern point of Interview island, situated about 4½ miles southward of the southern point of North Reef island, is low but rises 30 gradually to a wooded plateau, 370 feet (112^m8) high. The southern extremity of the island terminates in a cliff, close off which is a rocky pinnacle, 22 feet (6^m7) high. Reefs and shoals extend about 2 miles north-north-eastward of Interview island.

South Reef island, a wooded islet, lies about one mile south-westward 35 of the southern point of Interview island; it lies on a stony spit which, with depths of 3 fathoms (5^m5) and less, extends about 3 miles southward from that island.

Austen strait.—Austen strait, which separates North and Middle Andaman islands, is reported to be navigable at all stages of tide by 40 boats not exceeding a draught of 6 feet (1^m8). The strait is, for the most part, clear of dangers in the fairway, the shoalest parts being the bars at either entrance. The western entrance, situated about 8½ miles south-eastward of the northern extremity of Interview island, is approached through Austen harbour (Interview sound), which lies 45 between the northern part of Interview island and the mainland, and is encumbered with numerous islets, rocks and shoals.

WESTERN SIDE OF MIDDLE ANDAMAN ISLAND.—The western coast of Middle Andaman island extends southward for about 36 miles between the western entrances to Austen and Andaman straits. 50 Sound peak (White mountain), 1,184 feet (360^m9) high, situated about 7 miles east-south-eastward of the western entrance to Austen strait, appears whale-backed from south-westward. It stands at the northern end of the eastern coastal range of Middle Andaman island which

Chart 825.

terminates at the southern end of the island about 32 miles southward.

Port Andaman to Foul bay.—Coast.—Dangers.—Port Andaman, the entrance to which lies between South Reef island (*Lat. 12° 46' N., Long. 92° 40' E.*) and Anderson island, a long, narrow island lying close off Middle Andaman island, has muddy water and very irregular depths over a rocky bottom at its entrance. Port Andaman leads to Interview passage, a narrow channel between Interview island on the west, and Anderson island with Bennett island northward of it, on the east. This locality is dangerous, and Port Andaman and Interview passage should be avoided until they have been closely examined.

The entrance to Buchanan passage, the narrow channel separating Anderson island from the mainland eastward, is encumbered with reefs and unsuitable for anchorage. Tuft island, a sandy islet, 10 feet (3^m0) high, lies about 1½ miles southward of the southern end of Anderson island and about one mile offshore. From a projecting point on the coast abreast Tuft island, the western coast of Middle Andaman island trends southward for about 22 miles to Foul bay, on the northern side of the entrance to Andaman strait, and appears precipitous.

Rocky point, the extremity of a promontory projecting about 1½ miles westward from the adjoining coast, lies about 4½ miles south-south-westward of Tuft island; Hump islet lies about 1½ miles north-north-eastward, and Flat island about 4 miles southward, of Rocky point.

A shoal with a depth of 6 fathoms (11^m0) over it, lies about 2½ miles westward of Rocky point. Middle bank, about 17 miles west-south-westward of Rocky point, is described on page 306.

Charts 3145, plan of Port Anson, 1419.

Andaman strait.—The western entrance to Andaman or Middle strait, which separates Middle Andaman island from South Andaman island, is divided into two parts by Spike island. There are considerable depths in the outer part of the main entrance which passes northward of Spike island and is entered between the western entrance point of Foul bay and Breaker point, the north-western extremity of Spike island, about 1½ miles southward.

Abreast Foul bay, the entrance channel is about half a mile wide between shoals on either side, but narrows to 1½ cables between reefs extending from Steep point, the north-eastern point of Spike island, about one mile eastward of Breaker point, and Brook point, about 3 cables north-north-westward of Steep point.

About half a mile eastward of Steep point, Andaman strait forks. Homfray strait, the northern fork, separates Middle Andaman and Baratang islands and is described on page 330. The southern fork retains the name of Andaman strait, except for that part of it lying between Spike island on the west, and Stoa, Mangrove and Talakaicha islands on the east, which is known as Port Anson.

In 1946, hostile Jarawas were reported on the coast in the vicinity of Port Anson. See caution on page 22.

Chart 3145, plan of Port Anson.

Approaches to Port Anson.—Dangers.—Foul bay, on the northern side of the main entrance to Andaman strait, is filled with reef. Between Foul bay and Brook point, about 1½ miles south-south-eastward, the coast is fringed by a reef which extends about 1½ cables

Charts 1419, 825, 830, 70.

Chart 3145, plan of Port Anson.

offshore in places. Brook point rises to a rounded knoll, 316 feet (96^m3) high, about 1½ cables northward of its extremity.

Foul ground, near the southern end of which is a rock with a depth of 5 less than 6 feet (1^m8) over it, extends about 8½ cables southward from the western entrance point of Foul bay ; Half-tide rock (*Lat. 12° 19' N., Long. 92° 43' E.*), which dries 3 feet (0^m9), lies about 6 cables southward of the same point.

Spike island, the northern side of which forms the southern shore of 10 the entrance channel, is about 4 miles long in a north and south direction and is covered with dense jungle ; it is 448 feet (136^m6) high at its northern, and 309 feet (94^m2) high at its southern end.

Between Breaker point and Steep point, the northern coast of Spike island is fringed by a narrow reef, outside which a bank on which the 15 depths are less than 3 fathoms (5^m5), extends generally about 1½ cables offshore and as much as 2½ cables north-westward of Breaker point ; in 1942, a detached 2½-fathom (4^m6) patch was reported about 4 cables eastward of Breaker point and about 2 cables offshore.

Braganza ledge, situated about 4½ cables north-westward of Breaker 20 point, has a least depth of 4½ fathoms (8^m2) over it.

The western side of Spike island is fringed by a reef which in places extends as much as 1½ cables offshore, and a spit on which the depths are less than 3 fathoms (5^m5) lies with its outer end about three-quarters of a mile south-south-westward of Breaker point and about 25 3½ cables offshore. Rocks, from one to 6 feet (0^m3 to 1^m8) high, stand on the edge of the fringing reef, Long rock, 4 feet (1^m2) high, being about 1½ miles south-south-westward of Breaker point, and Cinque rocks, two groups of rocks each 6 feet (1^m8) high, lying about 3 and 5 cables, respectively, southward of Long rock.

30 Taylor patches, with a least depth of 4½ fathoms (8^m7), lie about 7 cables west-north-westward of Long rock, and a shoal area with depths of less than 10 fathoms (18^m3) and a least depth of 4 fathoms (7^m3), lies about half a mile west-south-westward of the same point.

The southern entrance to Port Anson lies between Spike island and 35 the northern end of South Andaman island, about 3 cables south-westward and, although deep, the channel is narrow and intricate.

Bluff island lies in the mouth of the southern entrance, about 6 miles southward of Breaker point and about a quarter of a mile northward of the northern end of South Andaman island. It is covered with 40 trees, the tops of which are about 100 feet (30^m5) high.

A drying reef extends about 2½ cables westward, and about 4 cables northward, from Bluff island.

The northern end of South Andaman island is 287 feet (87^m5) high and cliffy, and is fringed with a drying reef which extends about 45 2½ cables northward.

Port Anson.—Anchorage.—The eastern side of Spike island, which forms the western side of Port Anson, is mostly steep-to, but some islets and drying reefs lie within about 1½ cables of the shore in places.

50 Stoat island, the northern point of which lies about three-quarters of a mile eastward of Steep point (*Lat. 12° 18' N., Long. 92° 44' E.*), extends about 7 cables southward and is 140 feet (42^m7) high ; a very narrow drying reef fringes the western side of the island and extends about one cable from its northern and southern ends.

Chart 3145, plan of Port Anson.

Mangrove island, situated about $3\frac{1}{2}$ cables southward of Stoa island, is fringed by a drying reef which extends as much as $1\frac{1}{2}$ cables from its western side.

Talakaicha island (chart 1419), the northern part of which lies close eastward of Stoa and Mangrove islands, is also fringed by a narrow drying reef; a detached reef lies about 2 cables off its western side and about a similar distance south-south-westward of Mangrove island, and a detached ledge of rocks which dry 7 feet (2^m1), lies about 2 cables westward of the southern end of Talakaicha island and about $1\frac{1}{2}$ miles southward of Mangrove island.

In the southern part of Port Anson, about 7 cables westward of the southern end of Talakaicha island, are Whales reef and several other drying reefs, the positions of which may best be seen on the chart.

Anchorage.—Directions.—Anchorage may be obtained in the northern part of Port Anson, in depths of 9 or 10 fathoms (16^m5 or 18^m3), mud, about midway between Stoa island and the northern part of Spike island.

Vessels bound for Andaman strait from westward should approach the entrance keeping the low mangrove point at the northern end of Stoa island bearing 112° , and just open southward of Brook point, until within about a quarter of a mile of the latter point when they should alter course southward and keep in mid-channel between Brook point and Steep point; after rounding Steep point at a distance of from one to 2 cables, course may be shaped as necessary for the anchorage.

If proceeding through Andaman strait, vessels should steer southward in mid-channel through Port Anson until westward of the southern end of Mangrove island, when course should be altered slightly eastward until a sharp conical peak, northward, is seen bearing 003° and just open eastward of the nearer hills which form the western side of a large mangrove valley; course should then be shaped about 183° , and these marks kept on the bearing 003° as a stern mark, which leads between the ledge of rocks which dries about 7 feet (2^m1), and Whales reef and other reefs southward of it.

When the southern end of Talakaicha island bears 090° , course should be altered to about 220° for the southern point of Spike island, giving a berth of about 3 cables to the eastern side of the strait until about 6 cables distant from the southern point of Spike island, when course should be altered to pass about $1\frac{1}{2}$ cables eastward of it. When the southern point of Spike island bears 000° , course should be altered southward to proceed along the western side of the strait about 2 cables off the western shore.

When the western end of Baby island (*Lat. $12^\circ 11' N.$, Long. $92^\circ 44' E.$*), an island with two small hillocks, situated at the western end of the narrows, about 3 miles south-south-eastward of the southern end of Spike island, bears about 113° , vessels should steer to pass southward of it in mid-channel, and thus continue through the strait.

At spring tides, vessels should not attempt to pass through the narrows during the strength of the tidal stream, which is slack at the times of high and low water at Port Blair; at neaps, the tidal streams are scarcely felt.

Charts 1419, 825, 830, 70.

Chart 825.

WESTERN SIDE OF SOUTH ANDAMAN ISLAND.—Cape Bluff to Petrie island.—Coast.—Between Cape Bluff, situated about $2\frac{1}{2}$ miles south-westward of Bluff island (page 312), and Petrie island, situated on the northern side of the entrance to Port Campbell, about $15\frac{1}{2}$ miles south-south-westward, there are no known off-lying rocks or shoals.

South bank, the shoalest part of which lies about 15 miles west-north-westward of Cape Bluff, is described on page 306.

10 *Chart 1419, plan of Port Campbell.*

Port Campbell.—Caution.—Dangers.—The plan of Port Campbell on chart 1419 is reported to be inaccurate, and must therefore be used with great caution.

Port Campbell is a fine harbour, entered between Petrie island and
15 Montgomery island about $1\frac{3}{4}$ miles south-south-westward; it is almost landlocked and affords perfect shelter. The cliffs in the vicinity of the port are of yellowish-grey sandstone in which the strata shows very plainly.

Petrie island is connected by reefs and shoals with the north-western
20 point of Defence island, a long narrow island extending about 3 miles south-south-eastward which forms the eastern side of the outer part of the harbour. A shoal bank on which the depths are less than 3 fathoms (5^m5) fronts the southern side of Petrie island and the northern part of the western side of Defence island; it extends about
25 half a mile offshore southward of Petrie island, and a spit, near the outer end of which are some rocks, awash, extends as much as $1\frac{1}{2}$ miles south-south-westward from a position about three-quarters of a mile south-south-eastward of the north-western extremity of Defence island.

30 Montgomery island lies close off the mainland of South Andaman island, with which it is connected by rocks, both above-water and sunken.

A bank on which the depths are less than 3 fathoms (5^m5), fronts the eastern side of the port, its eastern edge extending in a northerly
35 direction from a position about 9 cables south-south-eastward of Montgomery island to a position about $5\frac{1}{2}$ cables north-eastward of that island; a detached patch with depths of from 5 to $6\frac{1}{2}$ fathoms (9^m1 to 11^m9), lies about three-quarters of a mile north-eastward of Montgomery island.

40 **Anchorages.—Directions.**—Anchorage may be obtained in the entrance to the port, in a depth of about 12 fathoms (21^m9), close north-eastward of the 5-fathom (9^m1) patch and about $8\frac{1}{2}$ cables north-eastward of Montgomery island. Anchorage may also be obtained, in depths of about 13 fathoms (23^m8), about $10\frac{1}{2}$ cables south-eastward
45 of Montgomery island.

In order to reach the latter anchorage keeping in a least depth of 10 fathoms (18^m3), it was recommended in 1915 that vessels should pass close northward of the 5-fathom (9^m1) patch in the entrance, steering 090° ; when the western extremity of Petrie island bears 000° ,
50 it should be brought and kept astern on that bearing as a stern mark until the northern point of Montgomery island bears 305° ; course should then be shaped 130° and the anchor dropped when the north-western extremity of Defence island (*Lat. $11^\circ 58' N.$, Long. $92^\circ 36' E.$*) bears 003° .

Charts 825, 830, 70.

Charts 1398, 825.

Port Campbell to Port Mouat.—Coast.—Very little is known of the stretch of coast between Montgomery island and Palmer point, about 15 miles southward, but it appears to have several salient points fringed with coral reef. 5

Constance bay, entered between Palmer point and Florence point, about 2 miles south-eastward, is filled with reef on which there are several islets; an above-water rock lies on the southern edge of this reef, about one mile southward of Palmer point. From Florence point the coast trends south-south-eastward for about $2\frac{1}{4}$ miles to Perseus point, the northern entrance point of Port Mouat. 10

Chart 1398.

Approaches to Port Mouat.—Dangers.—The entrance to Port Mouat lies between Perseus point and Andromeda point, about $8\frac{1}{2}$ cables southward; there are numerous dangers in the approaches and in the entrance to the port. 15

A rocky bank with depths of from $3\frac{1}{4}$ to 8 fathoms (5^m9 to 14^m6), extends about $1\frac{1}{4}$ miles westward and about 2 miles south-south-westward from the above-water rock, situated about one mile southward of Palmer point. In 1946, a 3-fathom (5^m5) patch, the position of which is approximate, was reported to lie near the southern extremity of this rocky bank. 20

Tarmugli island, the north-westernmost island of the Labyrinth group, lies with Frederick point, its north-western extremity, about $4\frac{1}{2}$ miles west-south-westward of Perseus point; it is 257 feet (78^m3) high, and its south-western extremity is cliffy with two rocks, 15 feet (4^m6) high, close off it. A continuous reef fringes the northern and western coasts of the island and extends as much as one mile off the latter coast. 30

A large area of foul ground extends about 3 miles northward from the reef fringing the northern coast of Tarmugli island; Allen patches, a part of which is awash, lies on the outer part of this foul ground about 2 miles north-eastward of Frederick point, and in 1946, a 3-fathom (5^m5) patch, the position of which is approximate, was reported to lie on the northern end of the foul ground, about $2\frac{1}{2}$ miles north-eastward of Frederick point. The northern edge of the foul ground is separated from the rocky bank extending southward from Palmer point by a clear channel about 7 cables wide. 35

A reef on which there are numerous drying and sunken rocks and rocks awash, fronts the coast between Florence point and Perseus point, extending as much as three-quarters of a mile west-south-westward of the latter point; Hooper patch, a shoal patch with a least depth of 2 fathoms (3^m7), lies close off its outer edge, about one mile westward of Perseus point. 40

A shoal bank, on the outer edge of which are rocks with less than 6 feet (1^m8) over them, extends about three-quarters of a mile westward from Andromeda point (*Lat. $11^{\circ} 37' N.$, Long. $92^{\circ} 37' E.$*). 45

Chart 1398, plan of Port Mouat.

Port Mouat.—Dangers.—Low wooded hills, the tops of which are about 100 feet (30^m5) high, stand close east-north-eastward of Perseus point. 50

For about 4 cables eastward of Perseus point, the northern shore of the port is fronted by a reef which extends about 3 cables offshore;

Charts 825, 830, 70.

Chart 1398, plan of Port Mouat.

a drying spit extends about $1\frac{1}{2}$ cables south-south-eastward from a position about $1\frac{1}{2}$ cables eastward of Perseus point.

Andromeda point and the southern shore of the port for about half a mile eastward, is fronted by a reef somewhat similar to that fronting the northern shore.

The navigable channel between the reefs extending from each entrance point, is about 3 cables wide, but two shoal patches, with depths of $2\frac{1}{2}$ and $2\frac{1}{2}$ fathoms (4^m1 and 4^m6), are situated in the middle of the fairway and divide the entrance into two channels, each about one cable wide with depths of from 6 to 10 fathoms (11^m0 to 18^m3).

At about $1\frac{1}{2}$ miles eastward of the entrance, the depths increase and the harbour contracts to a width of about $1\frac{1}{2}$ cables, the navigable channel, although deep, being only about half a cable wide; eastward of this narrow channel, the harbour opens out into a landlocked basin in which anchorage may be obtained in depths of from 4 to $5\frac{1}{2}$ fathoms (7^m3 to 10^m1).

Chart 1398.

20 Directions.—Caution.—The plan of Port Mouat on chart 1398 should be used with caution until the locality has been re-surveyed and, before entering, it would be advisable to buoy the $2\frac{1}{2}$ - and $2\frac{1}{2}$ -fathom (4^m1 and 4^m6) patches situated in the middle of the entrance.

Vessels approaching from northward should steer for Frederick point, keeping it bearing less than 180° until Perseus point bears 102° , when the latter point should be steered for on that bearing, which leads between the rocky bank extending southward from Palmer point and the foul ground extending northward from Tarmugli island. When Grub island, an islet situated about 2 miles south-south-westward of Andromeda point, bears about 159° and is in line with Mount Ford (Ford's peak) (page 319), course should be altered southward to keep these marks in line, which leads between Allen and Hooper patches. When the northern entrance point of the narrow channel leading to the inner basin bears 086° , it should be steered for on that bearing, which leads between the reef extending northward from Andromeda point and the two shoal patches in the middle of the entrance.

It is reported that local fishing craft approaching Port Mouat from southward, use Elphinstone passage, a channel leading westward of Red Skin island and between Tarmugli and Grub islands, but there are numerous dangers in the southern approach to this passage, see page 318.

Chart 825.

Outlying island.—North Sentinel island lies about 15 miles westward of Tarmugli island, the channel between being deep and clear of dangers in the fairway; the bottom is ooze. The island is 400 feet (121^m9) high, thickly wooded, and has a level ridge, which slopes to its very low north-western point (*Lat.* $11^\circ 35' N.$, *Long.* $92^\circ 13' E.$).

A coral reef nearly surrounds the island, extending from the coast for distances of from a half to three-quarters of a mile; the lagoons inside the reef have depths of from 3 to 8 feet (0^m9 to 2^m4). No dangers exist outside the reef, and there are depths of 100 fathoms (182^m9) 3 miles westward of the island.

There are several entrances through the reef practicable for boats, and there is an anchorage outside all of them for a vessel in the fine

Charts 830, 70.

Chart 825.

season. Four islets stand on the reef, the largest being Constance islet (*Lat. 11° 30' N., Long. 92° 17' E.*), close off the south-eastern extremity of the island. The best landing place and anchorage are on the eastern side of the island, where depths of 10 fathoms (18^m3) 5 may be obtained, half a mile offshore, with the north-eastern point bearing 283°; southward of this there are sunken dangers.

Other entrances and landing places indicated on the chart are: one on the north-western coast, just southward of a small islet; another, and probably the better with a wider break in the reef, is on the 10 southern side of the island, eastward of Antinous islet, a small islet, and about three-quarters of a mile westward of Constance islet.

Anchorage may be obtained in a depth of 12 fathoms (21^m9), about half a mile off the latter of the two entrances.

The natives are timid and hostile, and the island is seldom visited 15 by Europeans. See caution on page 22.

Chart 1398.

Labyrinth islands.—The Labyrinth islands consist of about 14 islands and islets lying close off the western side of South Andaman island, between the entrance to Port Mouat and the western entrance 20 to Macpherson strait. They are all rocky and are fringed with coral reefs which extend from about half a mile to one mile from their seaward sides; large blocks of these projecting reefs are broken off by the sea during the South-west monsoon, and are swept on to the reefs where they appear like rocky boulders. 25

Tarmugli island, the north-westernmost and largest of the Labyrinth islands, is described on page 315.

Grub island, 144 feet (43^m9) high, and with a high yellow cliff, lies about 1½ miles eastward of the eastern point of Tarmugli island. Boat island, 199 feet (60^m7) high, the south-westernmost of the group, lies 30 about 1½ miles south-eastward of the south-western point of Tarmugli island; a coral reef extends about one mile southward from it. Malay tapu, an island which is the south-easternmost of the group, about 2½ miles eastward of Boat island, has a rounded peak, 282 feet (85^m9) high at its northern end; a rocky ledge extends about a quarter of 35 a mile from its southern end.

The southern end of Red Skin island lies close north-westward of Malay tapu; it is reported that Elphinstone passage, which leads between the western side of Red Skin island and Snob island, an islet, 248 feet (75^m6) high about three-quarters of a mile westward, is used 40 by local fishing craft when proceeding northward to Port Mouat. Hobday island lies close north-eastward of Malay tapu; a rocky ledge extends about half a mile southward from its south-eastern side, and a ridge with depths of from 3½ to 4½ fathoms (6^m4 to 8^m2), extends about half a mile southward of the outer edge of the ledge. 45

Pluto island, 162 feet (49^m4) high, lies about half a mile eastward of Hobday island; a rock, 2 feet (0^m6) high and said to be a good mark at all states of the tide, lies about half a mile south-south-eastward of Pluto island (*Lat. 11° 32' N., Long. 92° 38' E.*).

Current.—From February to April, the current sets southward on 50 the seaward side of the Labyrinth islands but it occasionally reverses its direction for periods of about 24 hours.

Macpherson strait.—**Islands and dangers.**—Macpherson strait separates the Labyrinth islands and South Andaman island from

Chart 1398.

Rutland island ; the recommended channel has a least navigable width of 2 cables and a least depth of 4 fathoms (7^m3).

The western entrance is narrow and much obstructed by coral reefs.

- 5 Both shores of the strait are fringed with coral reefs, the edges of which show above water in places, but that portion of the strait which lies between the south-western side of South Andaman island and the north-eastern side of Rutland island, is clear except for a ledge of rocks which extends about 6 cables east-north-eastward from the north-
10 eastern point of Rutland island, and can always be distinguished.

- Jolly Boys island, 149 feet (45^m4) high, lies in the western part of the strait, about 9 cables south-south-eastward of Malay tapu ; a coral reef fringes the island and extends about 7 cables south-westward from it. Although the channels between the islands of the Labyrinth group
15 are mostly nearly full of coral heads, the channel between Malay tapu and Jolly Boys island is navigable with proper caution, and leads from Macpherson strait to Elphinstone passage which, as previously stated, leads westward of Red Skin island to the entrance to Port Mouat.

- Brooker's rock, a pinnacle rock with a depth of 5 feet (1^m5) over it,
20 lies on the north-western side of the channel, about 8 cables west-north-westward of the south-western end of Jolly Boys island ; it is usually hidden by discoloration of the water. Beauchamp patch, a small coral head, awash, lies on the south-eastern side of the channel, about 4 cables north-north-eastward of the north-eastern end of Jolly
25 Boys island ; it is also usually obscured on account of discoloured water. Peck shoals are a group of coral heads situated on the northern side of the channel, the southernmost of which lies about one mile north-north-eastward of the north-eastern end of Jolly Boys island.

- Anchorage.**—Anchorage may be obtained in depths of from 6 to
30 10 fathoms (11^m0 to 18^m3), on the northern side of the eastern part of the strait, with Chiriya tapu, the southern extremity of South Andaman island, bearing 125°, and a white rock, situated on the northern shore of the strait about 1½ miles north-north-westward of Chiriya tapu and reported to be a good mark, bearing about 058°.

- 35 **Tidal streams.**—In Macpherson strait, the tidal stream sets eastward with the rising tide and westward with the falling tide, the streams turning at high and low water.

- Tide rips are not strong in the vicinity of Brooker's rock and Beauchamp patch, and the tidal stream is rapid only in the narrows north-eastward of Rifleman island, a 162-foot (49^m4) islet situated about half
40 a mile eastward of the northern extremity of Rutland island.

- Directions.**—Vessels approaching Macpherson strait from westward should bring Jolly Boys island (*Lat.* 11° 30' N., *Long.* 92° 37' E.) to bear 051° when at a distance of 5 miles from that island, and should
45 keep it on that bearing until the northern end of Pluto island bears 034°, when the latter should be steered for on that bearing, keeping it open about one-third of its length south-eastward of the eastern side of Hobday island, which leads about midway between Brooker's rock and the reef extending south-westward from Jolly Boys island, which
50 is usually visible.

When the summit of Jolly Boys island is abeam, course should be shaped 052° towards the 2-foot (0^m6) rock about half a mile south-south-eastward of Pluto island, and when the southern extremity of Boat island bears 265°, and is seen just open southward of the southern

Chart 1398.

extremity of Malay tapu, this mark should be kept on astern, which leads between Peck shoals and Beauchamp patch. When the 2-foot (0^m6) rock south-south-eastward of Pluto island is abeam, course should be shaped to pass midway between Rifleman island and the north-eastern shore of the strait, whence a mid-channel course may be kept through the remainder of the strait. 5

WESTERN SIDE OF RUTLAND ISLAND.—Coast.—Islands and dangers.—Rutland island is densely wooded and access to it is difficult. The natives are hostile, *see* caution on page 22. 10

The northern and southern parts of the island are high and the two parts are joined together by a low neck of land. The northern and higher part attains an elevation of 1,422 feet (433^m4) in Mount Ford (Ford's peak), about 3 miles southward of the northern point of the island. Mount Mayo, 744 feet (226^m8) high, situated about 5½ miles south-south-eastward of Mount Ford, is the highest peak in the southern part. 15

Woodmason bay is situated on the western side of the island with its southern part abreast the low neck of land, about 4 miles southward of Mount Ford; the northern part of the bay is encumbered with reef, but its southern part appears to be free from rocks and shoals outside a distance of about 3 cables offshore. 20

A bank on which the depths are less than 10 fathoms (18^m3) extends about 4 miles westward from the southern part of the western coast of Rutland island. West Twin, 157 feet (47^m8) high, and East Twin, 144 feet (43^m9) high, are two level-topped and wooded islets, situated on a reef on the northern side of this bank, about 2½ and 2 miles, respectively, westward of the southern entrance point of Woodmason bay. 25

A rocky ledge extends about 8 cables south-westward from West Twin, with Turtle rock, which dries about 6 feet (1^m8), at its extremity; a spit with a depth of less than 5 fathoms (9^m1), extends about 8 cables southward from Turtle rock, and a patch with a least depth of 1½ fathoms (2^m7) lies near its extremity. 30

Investigator rock, over which there is a depth of 3 fathoms (5^m5), lies about 9 cables south-south-westward of the southern extremity of Rutland island; it is nearly always marked by tide rips. A 4½-fathom (8^m2) rocky patch lies about 3 cables north-north-eastward of Investigator rock. 35

Off-lying bank.—An extensive bank of dead coral with a least depth of 6 fathoms (11^m0) over it, lies with its centre about 6½ miles south-westward of the south-western extremity of Rutland island; in ordinary weather it is quite safe for vessels to pass over this bank. 40

Manners strait and the islands and passages southward of Rutland island, are described on page 343. 45

Chart 3103.

EASTERN SIDE OF NORTH ANDAMAN ISLAND.—Cape Price to Bond harbour.—Islands and dangers.—Between Cape Price (*Lat.* 13° 35' N., *Long.* 93° 02' E.) and the entrance to Gibb creek, about 7 miles southward, the coast is fronted by several rocky patches. Good landing may be effected at several places along this stretch of coast, but it should not be approached within a distance of 2½ miles by passing vessels. 50

Charts 825, 830, 70.

Chart 3103.

Pocock island, about $1\frac{1}{2}$ miles south-eastward of Cape Price, is 244 feet (74^m4) high and wooded. Foul ground, at the southern end of which is a rock, awash, extends about a quarter of a mile southward 5 from the island, and a rock which dries 4 feet (1^m2) lies about a quarter of a mile farther southward.

The outermost rocky patch lying off this stretch of coast is a 3-fathom (5^m5) patch, situated about 4 miles southward of Pocock island and about $1\frac{1}{4}$ miles offshore. Beauchamp reef, which is awash, lies about 10 $1\frac{1}{4}$ miles east-south-eastward of the entrance to Gibb creek and about 9 cables offshore.

Cadell bay lies between the southern entrance point of Gibb creek and Colvin point, about $2\frac{3}{4}$ miles south-eastward. Trilby island lies about 2 cables east-north-eastward of Colvin point, and Tree islet, 15 which is 45 feet (13^m7) high and has some low trees on it, lies about 3 cables east-north-eastward of the northern point of Trilby island. The passage between Tree islet and Trilby island is foul, with a drying rock in mid-channel.

Bond harbour is entered between Bayne (Tree) point, about one mile 20 south-south-eastward of Colvin point, and the southern end of Trilby island, about 4 cables northward; a spit with depths of less than 6 feet (1^m8) on it, extends about $2\frac{1}{2}$ cables northward from Bayne point.

Anchorages.—During the period of the South-west monsoon, good anchorage may be obtained in Cadell bay, in depths of from 6 to 25 7 fathoms (11^m0 to 12^m8), mud.

Anchorage sheltered except from northward may be obtained in the middle of Bond harbour, in depths of from 7 to 8 fathoms (12^m8 to 14^m6), sand and mud.

Off-lying danger.—Union ledge, which is nearly awash, lies about 30 $6\frac{3}{4}$ miles eastward of Pocock island; it lies near the south-eastern extremity of an extensive bank on which the depths are less than 20 fathoms (36^m6) and irregular, which extends east-south-eastward from East island (page 306). A patch, with depths of from 6 to 8 fathoms (11^m0 to 14^m6) over it, lies about three-quarters of a mile 35 eastward, and a 3-fathom (5^m5) patch lies about 4 cables southward, of Union ledge.

Table islands and adjacent dangers.—Table islands consist of Excelsior and Delgarno (Chirume) islands, two tree-covered islands which lie at the northern and south-western ends, respectively, of an 40 extensive shoal on which the depths are less than 3 fathoms (5^m5), and the southern extremity of which lies about one mile eastward of Bayne point.

Excelsior island lies about $1\frac{1}{2}$ miles eastward of the northern end of Trilby island, and is fringed by a reef which extends about 3 cables 45 from its north-eastern side; on its south-western side is a sandy beach which is steep-to.

Delgarno island (*Lat.* 13° 25' N., *Long.* 93° 06' E.), about three-quarters of a mile south-westward of Excelsior island, has a clear sandy beach on its north-western side and mangroves on its eastern 50 and southern sides. A fringing reef extends about 4 cables southward from the island.

Both Excelsior and Delgarno islands are comparatively steep-to on their western sides, but foul ground extends about one mile south-eastward from Excelsior island, and about $1\frac{1}{4}$ miles eastward from

Charts 825, 830, 70.

Chart 3103.

Delgarno island; outside the foul ground, irregular depths extend about $1\frac{1}{2}$ miles eastward of Excelsior island and about $1\frac{3}{4}$ miles eastward of Delgarno island (*Lat.* $13^{\circ} 25' N.$, *Long.* $93^{\circ} 06' E.$).

North Passage reef, which dries about 8 feet (2^m4), lies about half a mile westward of Excelsior island. The passage between this reef and Tree islet, about $4\frac{1}{2}$ cables westward, is clear of dangers.

A shoal with a least depth of $2\frac{1}{2}$ fathoms (4^m6) over it, lies about 9 cables north-eastward of Excelsior island.

Mushroom and Table reefs are two reefs about $1\frac{1}{2}$ cables apart, situated about $1\frac{1}{2}$ miles eastward of the southern end of Delgarno island; they each dry about 4 feet (1^m2) and are usually visible.

Chart 825.

South Passage reef which dries about 8 feet (2^m4), lies in the southern entrance to the passage between Table islands and the coast of North Andaman island; a shoal spit extends about 4 cables east-south-eastward from the reef, and vessels using this passage should pass westward of the reef.

When passing eastward of Table islands, vessels should keep in depths of more than 20 fathoms (36^m6).

Bayne point to Mangrove point.—Islets and dangers.—From Bayne point, the coast trends south-westward for about $1\frac{3}{4}$ miles to the entrance to Thoroughfare creek, a narrow channel separating Smith island from the eastern coast of North Andaman island. Temple island is a wooded islet lying about half a mile north-eastward of the northern extremity of Smith island, which forms the southern entrance point of Thoroughfare creek; a shelving reef extends about $2\frac{1}{2}$ cables from its eastern side and a rocky ledge, which dries about 8 feet (2^m4), lies about $3\frac{1}{2}$ cables eastward of the islet.

Smith island attains an elevation of 415 feet (126^m5); Mangrove point; its eastern extremity, situated about $3\frac{1}{2}$ miles south-eastward of the entrance to Thoroughfare creek, is a bluff point fronted by a drying reef which extends about 2 cables offshore.

Turtle islands, two islets about 150 feet (45^m7) high and wooded, are situated about $1\frac{3}{4}$ miles north-north-westward of Mangrove point; a fringing reef surrounds each islet and there is a sandy beach on the north-western side of the south-western islet. Turtle reef, with a sandbank 4 feet (1^m2) high in the middle, lies about half a mile northward of the islets, and a 4-fathom (7^m3) patch lies about half a mile east-south-eastward of Turtle reef.

There is a clear passage from 3 to 4 cables wide, between Turtle islands and the eastern coast of Smith island, with depths of not less than 11 fathoms (20^m1) in the fairway.

Chart 2986.

Approaches to Port Cornwallis.—Dangers.—The entrance to Port Cornwallis lies between Ross island (Bopung), situated about $2\frac{1}{2}$ miles south-south-westward of Mangrove point, and Dundas point, about $1\frac{3}{4}$ miles farther south-south-westward. There are considerable depths in the entrance and the harbour affords sheltered anchorage at all seasons. In 1931, no inhabitants were seen at Port Cornwallis.

Back bay is a bight open eastward, lying between Mangrove point and Ross island. One-Fathom shoal, which lies in the approach to the bay, about one mile south-eastward of Mangrove point, has a least depth of one fathom (1^m8) over it; the sea only breaks over this shoal in heavy weather.

Charts 825, 830, 70.

Chart 2986.

Tree islet in line with Cape Price (chart 825) bearing 341° , leads eastward of One-fathom shoal, and Hand hill (Hand peak), a sharp wooded hill, situated about $2\frac{3}{4}$ miles west-south-westward of Dundas point, in line with the south-eastern side of Ross island, bearing 235° , leads south-eastward of it.

Back Bay reef, about one mile southward of Mangrove point, dries 5 feet (1^m5) and is generally visible at high water, except when the sea is very smooth.

- 10 Ross island (*Lat.* $13^{\circ} 18' N.$, *Long.* $93^{\circ} 05' E.$) is connected with Smith island by a sandy spit and is almost entirely surrounded by a drying reef lying on a bank which, with depths of less than 5 fathoms (9^m1), extends as much as $4\frac{1}{2}$ cables eastward, and about 3 cables southward, from the island. North reef, which dries about 8 feet
- 15 (2^m4), lies about $3\frac{3}{4}$ cables south-eastward of Ross island.

- Dundas point is sharp and rocky, and is fronted by a narrow drying reef which extends about $1\frac{3}{4}$ cables north-north-eastward from its extremity; the point rises to an elevation of 426 feet (129^m8) about $3\frac{3}{4}$ cables within its extremity. A 2-fathom (3^m7) rocky patch lies
- 20 about 7 cables north-eastward of the point, and a shoal patch with a least depth of 4 fathoms (7^m3) and steep-to, lies about $5\frac{1}{2}$ cables east-north-eastward of the same point. South reef, which dries about 8 feet (2^m4), lies about 4 cables eastward, and Middle reef, which also dries about 8 feet (2^m4), lies about a similar distance south-south-
- 25 eastward, of Dundas point.

- Port Cornwallis.—Islands and dangers.**—Hood point, situated on the north-eastern side of the harbour, about 4 cables north-westward of the western point of Ross island, is the southern extremity of Smith island. Minerva bay is entered between Hood point and Perseverance
- 30 point, about $1\frac{3}{4}$ miles north-westward. A bank on which the depths are 10 fathoms (18^m3) and less, extends about three-quarters of a mile south-eastward from Perseverance point across the entrance to Minerva bay, and on its outer part is a large rocky patch with depths of from 6 to 8 fathoms (11^m0 to 14^m6).

- 35 Atalanta bay, on the south-western side of the harbour, is entered between Dundas point and Barkeley (Rocky) point, about $1\frac{1}{4}$ miles west-north-westward. A rocky patch with a least depth of $3\frac{1}{4}$ fathoms (5^m9) lies near the middle of the bay, about $8\frac{1}{2}$ cables westward of Dundas point.

- 40 Brush island is an islet composed of broken coral and stones with some trees, the tops of which are about 20 feet (6^m1) high; it lies nearly in mid-channel about three-quarters of a mile north-north-eastward of Barkeley point and is surrounded by reef. A shoal with a least depth of 3 feet (0^m9) over it at its western end, lies about
- 45 9 cables westward, and a rock which dries 8 feet (2^m4), lies about one cable south-eastward, of the islet. There is good fishing off Brush island.

- Chatham island, about $1\frac{1}{2}$ miles long in a north and south direction, is situated on the south-western side of the harbour with its northern
- 50 end about $1\frac{1}{4}$ miles west-north-westward of Perseverance point; it rises to an elevation of 200 feet (61^m0) near its southern end, and is covered with jungle.

Jungle island (Low islet), lying on the northern side of the harbour and in the entrance to Thoroughfare creek, is situated about one mile

Chart 2986.

northward of Perseverance point. North island (*Lat.* 13° 20' N., *Long.* 93° 02' E.) lies about one mile westward of Jungle island, and Wharf and South islands, two islets, lie about 2 and 5 cables, respectively, westward of the southern end of North island. 5

The western part of the harbour is very shallow, but a narrow channel with depths of not less than 3 fathoms (5^m5), leads between Wharf and South islands, and thence south-westward into Blair bay, an extensive but very shallow backwater surrounded by mangroves.

Anchorage.—Directions.—During the South-west monsoon, 10 vessels may obtain good anchorage in the entrance to Atalanta bay.

The best anchorage berth is north-eastward of the northern end of Chatham island, about midway between that island and Jungle island, in depths of from 6 to 8 fathoms (11^m0 to 14^m6).

Vessels entering Port Cornwallis should keep Brush island bearing 15 287° and in line with South point, the southern extremity of Chatham island; when the northern extremity of Chatham island bears 313° and is in line with the western extremity of Wharf island, it should be steered for on that bearing until Perseverance point is abeam, when course may be shaped as requisite for the anchorage. 20

Climate.—The climate of the port was supposed to be unhealthy, but there appears reason to doubt this as, during the survey, a party remained on Chatham island for one month without any sickness occurring.

Chart 825.

Dundas point to Cadell point.—Coast.—From Dundas point, the coast trends south-south-westward for about 15 miles to Cadell point. Craggy island, about 3 miles southward of Dundas point, is connected with the main island by a reef, on the southern side of which, vessels with local knowledge may obtain good anchorage. The coast in this 30 vicinity appears to be thickly populated.

Taralait bay lies about 9 miles southward of Craggy island, whence the coast trends south-westward for about 3 miles to Cadell point, the northern entrance point of Stewart sound.

North Saddle peak and Saddle hill, situated about 6 miles south- 35 westward, and 7½ miles south-south-westward, respectively, of Dundas point, have been described on page 307.

Chart 2455.

STEWART SOUND.—General remarks.—Stewart sound lies within Sound island, between Cadell point and Cape Vestal (Kinserley 40 point), about 11 miles south-south-westward. The sound contains several inlets, and anchorage may be obtained in almost any part of it, but Bacon bay, an inlet in the south-western part, is the only one in which anchorage can be recommended at all seasons. The hills surrounding the sound are covered with dense jungle. 45

The eastern entrance to Austen strait, which separates North and Middle Andaman islands, lies at the head of a shallow bay on the southern side of the sound.

Sound island.—Dangers.—Sound island is an irregularly-shaped island lying in the entrance to the sound with Simpson (North) point, 50 its north-eastern extremity, about 1½ miles southward of Cadell point; rocks, both above-water and sunken, extend about 4½ cables north-eastward from Simpson point.

Chart 2455.

Ridges of high land traverse Sound island in all directions, and are prolonged in spurs up to the entrance points of the numerous bays which indent the coasts of the island; the latter are mostly lined by a belt of mangroves, and fringed by coral reefs and by occasional sandy beaches.

Mitchell point (*Lat.* $12^{\circ} 56' N.$, *Long.* $92^{\circ} 59' E.$), the south-eastern extremity of Sound island, lies about $4\frac{1}{4}$ miles south-south-westward of Simpson point; a drying reef extends about $3\frac{1}{2}$ cables south-south-westward from Mitchell point, and on the western side of its outer part is Square rock, 14 feet (4^m3) high and a good mark.

Jones point, the south-western extremity of Sound island, lies about $1\frac{3}{4}$ miles west-north-westward of Mitchell point; a drying reef on which there is a ridge of rocks terminating in one that dries 8 feet (2^m4), extends about $8\frac{1}{2}$ cables southward from the point. In 1923, there were several red-roofed bungalows on Jones point.

Good landing may be effected in a small sandy bay on the eastern side of the island, about one mile northward of Mitchell point.

Northern entrance.—Dangers.—The northern entrance to the sound lies between Cadell point and Simpson point. Elfin patch, which lies near the middle of the entrance, about one mile south-eastward of Cadell point, has a depth of less than 6 feet (1^m8) near its centre. Morland rock, about 4 cables south-westward of Cadell point, dries 8 feet (2^m4); shoal depths with a $2\frac{1}{2}$ -fathom (4^m6) patch near its outer end, extends about 3 cables south-south-eastward from Morland rock.

Oliver island lies about one mile westward of Simpson point and about 3 cables off the northern coast of Sound island; its northern and eastern sides are fringed by reef and shoal banks, which extend as much as $1\frac{3}{4}$ cables northward from the island, but its south-western side is steep-to and there are considerable depths in the channel which separates it from Sound island.

Sunk reef, which dries 2 feet (0^m6) and has a 3-fathom (5^m5) patch on its north-western side, is situated about 7 cables west-north-westward of Oliver island. A group of rocks which dry 8 feet (2^m4), lies in mid-channel about 9 cables westward of Oliver island, and depths of less than 5 fathoms (9^m1) extend about $2\frac{3}{4}$ cables south-westward of the group. Oyster island, 4 feet (1^m2) high, lies about 8 cables west-south-westward of Oliver island.

Stewart island, a large island covered with dense jungle, is situated in a shallow bay at the north-western corner of Stewart sound, its south-eastern extremity lying about $2\frac{1}{2}$ miles westward of Oliver island; its north-western side is connected with the main island by a drying mudbank.

Marsack shoals are two small coral patches lying at the southern end of the channel between Sound island and North Andaman island, about 5 cables north-westward, and $8\frac{1}{2}$ cables west-north-westward, respectively, from Jones point; there is a least depth of $3\frac{1}{2}$ fathoms (5^m9) over the eastern, and of $1\frac{1}{2}$ fathoms (2^m7) over the western patch.

Anchorage.—Anchorages are indicated on the chart on the northern side of the northern entrance, about 9 cables northward of Oliver island, in depths of from 8 to 9 fathoms (14^m6 to 16^m5), and in the channel between Sound island and North Andaman island, in depths of 9 fathoms (16^m5), about 2 miles northward of Jones point, but both these anchorages appear to afford little shelter from north-eastward.

Charts 825, 830, 70.

Chart 2455.

Southern entrance.—Dangers.—Buoy.—The southern entrance to Stewart sound lies between Mitchell point (*Lat. 12° 56' N., Long. 92° 59' E.*) and Cape Vestal, about 5 miles south-south-westward.

Five-Fathom patch, with a least depth of 5 fathoms (9^m1) over it, 5 lies nearly in the middle of the southern entrance, about 2½ miles south-south-westward of Mitchell point.

Convict patch, a shoal on which the depths are less than 3 fathoms (5^m5) and with rocks on it on which the depths are less than 6 feet (1^m8), lies about one mile northward of Cape Vestal. A 6-fathom 10 (11^m0) patch lies about 1½ miles east-south-eastward of Convict patch.

Sound peak (White mountain), 1,184 feet (360^m9) high and covered in dense jungle, lies about 2 miles west-south-westward of Cape Vestal ; it stands at the northern end of the eastern coastal range of Middle Andaman island. 15

Aves island, 207 feet (63^m1) high, on the southern side of the entrance about 1½ miles south-westward of Jones point, is easily identified from seaward ; it is connected with Aves point about 7 cables west-south-westward of it, by a coral reef which dries in places. Takla Oyster (Kwangtung) point, about 1½ miles west-north-westward of 20 Aves island, is the northern extremity of a promontory which forms the eastern side of a shallow bay, at the head of which is the eastern entrance to Austen strait.

A shoal with a least depth of 2½ fathoms (4^m6) lies about 4½ cables eastward of Takla Oyster point ; a white conical buoy is moored on 25 the northern side of the shallowest part of the shoal.

In 1930, Takla Oyster point had been cleared of trees and on it were a number of bungalows, one of which, with a red roof, stood at an elevation of about 100 feet (30^m5). The settlement of Bonington is situated on the point, and in 1952, a conspicuous white house with 30 a red roof, stood on the eastern side of the promontory, about 1½ cables south-south-eastward of the northern extremity of Takla Oyster point.

A stone pier projects about 120 feet (36^m6) east-north-eastward from the coast close southward of the conspicuous white house ; the head of the pier dries at low water. 35

A wooden jetty projects about 110 feet (83^m5) westward from the western side of the promontory, about one cable south-south-westward of the northern extremity of Takla Oyster point ; in 1952, there was a least depth of 8 feet (2^m4) alongside its head. Close westward of 40 Takla Oyster point are the ruins of a large sawmill, and a few piles close off the coast between these ruins and the wooden jetty, mark the remains of a pier.

Berkeley group consists of Orchid, Curlew, Egg and Dottrel islands, four islets situated in the approach to Bacon bay, northward and north-westward of Takla Oyster point, the exact positions of which 45 may best be seen on the chart.

Orchid island is covered with trees and jungle ; a reef extends about one cable south-eastward from it, except for which, it is steep-to. Egg island is also densely wooded.

In 1922, Curlew island had been cleared of most of the trees and the 50 top levelled, being about 100 feet (30^m5) high ; its northern side is very steep. There are still several trees remaining standing and there are numerous wooden huts on the island ; these, together with a red-roofed bungalow on its north-eastern side, make the island easy to identify. 55

Charts 825, 830, 70.

Chart 2455.

Bacon bay.—Bacon bay is entered between Brown point, which is covered with trees and jungle and is situated about $2\frac{1}{2}$ miles west-north-westward of Jones point, and Orchid island, about 7 cables 5 west-south-westward; it is an excellent harbour, sheltered from all winds with its eastern part clear of dangers outside a distance of 2 cables offshore, but it is seldom used.

Ray hill (*Lat. $12^{\circ} 58' N.$, Long. $92^{\circ} 56' E.$*) is a conspicuous conical hill, situated about $1\frac{1}{2}$ miles north-north-eastward of Brown point; it is 10 covered with dense jungle and can easily be distinguished by vessels approaching the southern entrance to Stewart sound.

Anchorage.—Vessels wishing to communicate with Bonington settlement may obtain good anchorage, in depths of 10 fathoms (18^m3), mud, with Egg island bearing 272° , distant 5 cables, and the 15 southern point of Orchid island bearing 023° . There is also anchorage farther westward, off Dottrel island, but space here is somewhat confined and caution is necessary when anchoring.

Good anchorage, sheltered from all winds, may be obtained near the head of Bacon bay, in depths of from 12 to 14 fathoms (21^m9 to 20 25^m6), with Ray hill bearing about 095° , about 4 cables from the eastern shore of the bay.

Tidal streams.—In Stewart sound the tidal stream sets northward with the rising tide and southward with the falling tide, attaining a rate at springs of $1\frac{1}{2}$ knots in the narrow parts of the sound. South- 25 ward of Camp bay, a small bight on the northern side of the northern entrance, about $1\frac{3}{4}$ miles north-westward of Oliver island, the north-going stream has a rate of a quarter of a knot and the south-going stream a rate of 2 knots.

Close northward of Takla Oyster point, the stream sets south- 30 westward with the rising tide and north-eastward with the falling tide. During the strength of the South-west monsoon the former stream is very weak but the latter stream attains a rate of about 3 knots.

Directions.—Vessels approaching from northward and entering by the southern entrance, should round Square rock at a distance of about 35 6 cables, and should thence steer for Orchid island on a bearing of 287° . If proceeding to the anchorage off Takla Oyster point, when Egg island bears 272° , it should be steered for on that bearing, which leads to the anchorage recommended above. Care must be taken to keep Egg island bearing not more than 272° until well clear of the $2\frac{1}{2}$ -fathom 40 (4^m6) shoal eastward of Takla Oyster point.

If proceeding to the anchorage in Bacon bay, after rounding Square rock as directed above, Orchid island should be kept bearing 287° until the summit of Aves island bears 135° , when it should be brought and kept astern on that bearing, which leads into Bacon bay passing 45 midway between Orchid island and Brown point. When the summit of Ray hill bears 050° , course may be shaped northward for the anchorage at the head of the bay.

Vessels from southward should approach the southern entrance keeping Ray hill bearing 332° and just open south-westward of Jones 50 point, until Orchid island is seen about midway between Aves island and Jones point, and bearing about 287° , when the directions given above should be followed.

Settlement.—In 1932, there were no Europeans in Bonington settlement. The District Forest officer resides in the conspicuous white

Charts 825, 830, 70.

Chart 2455.

house on the promontory terminating in Takla Oyster point ; landing can be effected here in ship's boats at a pontoon which is secured to the head of the stone pier close southward of this house.

Provisions are scarce and can only be obtained in small quantities, 5 and water is also scarce, except in the rainy season.

Chart 825.

EASTERN SIDE OF MIDDLE ANDAMAN ISLAND.—Cape Vestal to Johns point.—Coast.—From Cape Vestal, the eastern coast of Middle Andaman island trends south-south-eastward for 10 about 9 miles to Cape Strachan, the northern entrance point of Cuthbert bay, and thence trends southward for about 13 miles to Coxon point. The whole of this stretch of coast is high, and about $3\frac{1}{2}$ miles westward of Cape Strachan is Mount Diavolo, 1,678 feet (511^m5) high. 15

Chart 1419.

Rongat bay is entered between Coxon point (*Lat.* $12^{\circ} 29' N.$, *Long.* $92^{\circ} 59' E.$) and Johns point, about three-quarters of a mile southward. Coxon point is bold and bluff ; a rock which dries 4 feet (1^m2) lies about three-quarters of a mile east-north-eastward of it, and shoals, the outermost of which has a depth of 4 fathoms (7^m3), extend about 20 $2\frac{1}{4}$ miles eastward of the point. Johns point is also bold and bluff ; it is comparatively steep to except on its south-eastern side, where a reef, the outer end of which dries 4 feet (1^m2), extends about half a mile south-eastward.

Anchorage in Rongat bay may be obtained by vessels with local 25 knowledge, on a line joining the entrance points, in depths of from $3\frac{1}{2}$ to 5 fathoms (6^m4 to 9^m1) ; within the entrance, the bay is shallow with its head fringed by mangroves and fronted by drying reefs.

Charts 3145, plan of Elphinstone harbour, 1419.

ELPHINSTONE HARBOUR AND APPROACHES.—General 30 remarks.—Long island is the northernmost of a chain of islands, reefs and shoals, which extend southward for about 15 miles ; it lies with Cape Topham, its northern extremity, about $2\frac{1}{4}$ miles southward of Johns point. The islands are separated from each other, and from the eastern coast of Middle Andaman and Baratang islands, by narrow 35 channels ; most of the bays and inlets formed by the islands are intricate and encumbered with shoals, but shelter may be found in them by vessels with local knowledge. Elphinstone harbour lies close to the eastern entrance to Homfray strait, which separates Middle Andaman and Baratang islands, and is situated about $8\frac{1}{2}$ miles south- 40 south-westward of Cape Topham ; this harbour affords sheltered anchorage, and the principal dangers in the harbour and its main approach, are marked by buoys.

Long island.—Off-lying dangers.—Long island, which is densely wooded, extends about $4\frac{1}{2}$ miles south-south-westward between Cape 45 Topham and Cape Smith, its southern extremity. Reefs and shoals extend in places as much as $3\frac{1}{2}$ cables from its northern, eastern and southern coasts, but its western coast is joined to Middle Andaman island by a shallow flat over which the depths are mostly less than one fathom (1^m8). 50

Chart 1419.

Anderson rock, which dries one foot (0^m3), lies about one mile eastward of Cape Topham.

Charts 825, 830, 70.

Chart 1419.

Campbell shoal, with a least depth of 3 fathoms (5^m5), rock, lies on the eastern side of an extensive bank on which there are depths of from 9 to 20 fathoms (16^m5 to 36^m6), about 5 miles eastward of Anderson 5 rock.

Headlam patch, with a depth of 2 fathoms (3^m7), rock, lies about $2\frac{1}{2}$ miles south-south-eastward of Cape Topham and about $1\frac{1}{2}$ miles off the eastern side of Long island.

An extensive shoal with a depth of $2\frac{1}{2}$ fathoms (4^m6) near its south-10 western end, and $4\frac{1}{2}$ fathoms (8^m2) near its north-eastern end, lies between $5\frac{1}{4}$ and $7\frac{3}{4}$ miles eastward of Cape Smith; a detached shoal, with a least depth of 2 fathoms (3^m7), lies about one mile south-south-eastward of the south-western end of the extensive shoal.

North Button island, about 2 miles south-eastward of the last 15 mentioned shoal, and the islands fronting Diligent strait, are described with that strait on page 330.

Chart 3145, plan of Elphinstone harbour.

Osmaston shoal, with a least depth of $2\frac{1}{2}$ fathoms (4^m6), lies about $1\frac{1}{4}$ miles eastward of Cape Smith.

20 **Channel between Long island and Guitar island—Buoys.**

Guitar island lies about three-quarters of a mile south-south-westward of Long island, and the small Round island (*Lat. $12^{\circ} 20' N.$, Long. $92^{\circ} 55' E.$*) lies about one cable westward of it; the seaward side of Guitar island is fringed by a reef, and foul ground extends as much as 25 a quarter of a mile off its eastern side and 3 cables south-south-eastward from Cape Dalrymple, its southern extremity, situated about 2 miles south-south-westward of Cape Smith.

About 8 cables west-north-westward of Cape Smith is a forest camp, from which a trolley leads to a wooden jetty which projects from the 30 western side of Long island, about 4 cables northward of the camp; there is a least depth of $7\frac{1}{2}$ feet (2^m3) alongside the jetty. A small settlement is situated close to the root of the jetty.

The fairway of a channel, leading between Long island and Guitar island to a position about half a mile westward of the jetty, is marked 35 by buoys. Three small black spherical buoys are moored about $1\frac{1}{2}$ cables southward, about 4 cables west-south-westward, and about 9 cables west-north-westward, respectively, of Cape Smith, and mark the north-eastern side of the channel; the latter buoy is surmounted by a staff and ball. A similar buoy is moored about 4 cables north-40 ward of the northern extremity of Guitar island, and marks the south-western side of the channel. There is a least depth of 5 fathoms (9^m1) in the buoyed channel.

Charts 3145, plan of Elphinstone harbour, 1419.

Two small black conical buoys are moored about 4 and $5\frac{1}{2}$ cables, 45 respectively, westward of the wooden jetty, and mark the entrance to a narrow channel which, with depths of from $3\frac{1}{2}$ to 7 fathoms (6^m4 to 12^m8), leads north-north-westward for about $2\frac{1}{2}$ miles to the entrance of some creeks which extend into Middle Andaman island.

*Chart 3145, plan of Elphinstone harbour.*50 **Approaches to Elphinstone harbour.—Dangers.—Buoy.**

The entrance to Elphinstone harbour lies between Cape Dalrymple and Cape Portman, the northern extremity of North Passage island, about $1\frac{1}{2}$ miles south eastward. Nancowry ledge, with depths of less than 6 feet (1^m8) over it, lies with its southern extremity about $1\frac{1}{2}$ miles

Charts 1419, 825, 830, 70.

Chart 3145, plan of Elphinstone harbour.

eastward of Cape Dalrymple; a red conical buoy is moored close off the southern end of Nancowry ledge.

The eastern side of North Passage island, which extends about $4\frac{1}{2}$ miles southward from Cape Portman, is fronted by foul ground with coral heads and shoal patches, which extend from one to $2\frac{1}{4}$ miles offshore.

Strait island, lying about three-quarters of a mile south-south-eastward of North Passage island, is fringed by a reef on its northern and eastern sides, and foul ground and shoals with depths of less than 5 fathoms (9^m1), extend as much as 2 miles eastward from the island. A spit with depths of from $2\frac{3}{4}$ to $4\frac{1}{2}$ fathoms (5^m0 to 8^m2), extends about 5 cables south-south-westward from Cross point, the southern extremity of Strait island.

The channel between North Passage island and Strait island, is 15 obstructed by foul ground and shoals.

Elphinstone harbour. — Dangers. — Buoys. — Elphinstone harbour is formed by the northern part of the channel which separates North Passage island, the north-western point of which lies about $2\frac{1}{4}$ miles south-westward of Cape Portman, from the eastern side of Baratang island westward of it. There are depths of about 15 fathoms (27^m4) in the fairway of the entrance, and of about 11 fathoms (20^m1) inside it, but there are numerous reefs and shoals within the harbour, the positions of which may best be seen on the chart.

Cape Portman (*Lat. $12^\circ 19' N.$, Long. $92^\circ 57' E.$*) is the extremity of a narrow promontory which extends about $1\frac{1}{2}$ miles northward from the northern side of North Passage island, and parallel with it and about one mile westward, is Balfour reef which extends about one mile northward from the island; between them is Merk bay, which is deep.

A shoal spit, over which there is a least depth of 2 fathoms (8^m7), extends about 7 cables south-south-eastward from Cape Dalrymple; a can buoy, painted in green and yellow horizontal bands, is moored close southward of the spit.

A small 5-fathom (9^m1) patch lies about one mile south-south-eastward of Cape Dalrymple, and is marked by a can buoy, painted in black and yellow vertical stripes and surmounted by a yellow topmark.

A red conical buoy is moored about $1\frac{1}{2}$ miles westward of Cape Portman, and marks the northern extremity of Balfour reef.

A yellow conical buoy with a red topmark is moored about $6\frac{1}{2}$ cables west-north-westward of the north-western point of North Passage island, and marks the eastern edge of a detached reef close off the north-eastern point of Baratang island.

A yellow conical buoy with a green topmark is moored about one mile south-westward of the north-western point of North Passage island, and marks the north-eastern edge of a detached reef close off the eastern side of Baratang island.

A can buoy, painted in black and white vertical stripes, is moored about $9\frac{1}{2}$ cables south-south-westward of the North-western point of North Passage island, and marks the northern edge of a rocky shoal close off the western side of that island.

Anchorage.—Directions.—Anchorage may be obtained in a depth of about 10 fathoms (18^m3), good holding ground, about 3 cables off the coast of North Passage island, with the north-western point of that

Charts 1419, 825, 830, 70.

Chart 3145, plan of Elphinstone harbour.

island bearing about 029° , distant $5\frac{1}{2}$ cables. At this anchorage, the current is hardly perceptible.

When approaching Elphinstone harbour, a conspicuous tree on the 388-foot (118^m3) hill, situated on the northern entrance point of Homfray strait, about 2 miles west-south-westward of Cape Dalrymple, may be a useful mark.

When passing between the north-western point of North Passage island and the reef marked by a red conical buoy with a red topmark, vessels should keep in mid-channel.

Homfray strait.—Homfray strait, the eastern entrance to which lies about $1\frac{3}{4}$ miles north-westward of the north-western point of North Passage island, is an intricate and rocky channel connecting Elphinstone harbour with Port Anson on the western side of Middle Andaman island. The depths in the fairway of the strait are not less than $2\frac{3}{4}$ fathoms (5^m0), except near its eastern entrance where there is a wide bar, over which there is apparently a depth of $1\frac{1}{2}$ fathoms (2^m7), sand and gravel. The tidal streams are strong with many eddies.

Colebrooke passage.—**Anchorage.**—Colebrooke island lies between the southern part of North Passage island and the eastern coast of Baratang island, being separated from North Passage island by Mills passage and from Baratang island by Colebrooke passage.

Colebrooke passage is about 2 cables wide with depths of from 4 to 10 fathoms (7^m3 to 18^m3). Well sheltered anchorage with good holding ground may be obtained in a depth of $8\frac{1}{2}$ fathoms (15^m5) at the southern end of Colebrooke passage, with the south-eastern extremity of Colebrooke island (*Lat. $12^{\circ} 13' N.$, Long. $92^{\circ} 55' E.$*) in line with Middle Button island (chart 1419), bearing about 065° ; the space available for anchorage, with depths of over 3 fathoms (5^m5), is about $2\frac{1}{2}$ cables in diameter.

Chart 1419.

EASTERN SIDE OF BARATANG ISLAND.—**Coast.**—**Anchorage.**—From the entrance to Homfray strait, the eastern coast of Baratang island trends south-south-westward for about 16 miles to the entrance to Andaman strait, and is deeply indented with bays and inlets in which anchorage may be obtained by vessels with local knowledge, except during the South-west monsoon, when there is probably a heavy ground swell. This stretch of coast is fringed with reef on which mangroves grow, and is backed by hilly country.

Anchorage is indicated on the chart on the western side of Strait island (page 329), about 3 cables north-north-westward of Cross point, in depths of about 10 fathoms (18^m3), and also in Horsford bay, situated on the eastern side of Baratang island, about 4 miles south-south-westward of the southern entrance to Colebrooke passage, in depths of from 4 to 5 fathoms (7^m3 to 9^m1).

Andaman strait is described on page 335.

DILIGENT STRAIT.—**Islands and dangers.**—**Anchorage.**—Diligent strait lies between North Button island, an islet lying about $7\frac{1}{2}$ miles eastward of Cape Portman, Middle Button island, about 3 miles south-westward of North Button island, and Strait island, on the north-west; and Outram island, South Button island and Wilson island, on the south-east. The least depth in the fairway of the strait

Charts 825, 830, 70.

Chart 1419.

is 6 fathoms (11^m0), about 2 miles south-eastward of Strait island.

North Button island is 207 feet (63^m1) high, and terminates in low, irregular cliffs at its eastern point, and its western part descends abruptly to a spit of sand covered with trees. Shoals, with depths of less than 5 fathoms (9^m1), extend about 9 cables eastward and 3 cables westward from the islet; the eastern end should not be approached within 1½ miles, and the western end within three-quarters of a mile in those directions. The northern side of the islet is clear of dangers, but the bottom is rocky. Good anchorage may be obtained off the southern side of the islet, close to the fringing reef.

The northern end of Middle Button island is cliffy, but the south-western point terminates in a short sand spit, with a few low rocks off it.

Shoals, with depths of from 2½ to 4½ fathoms (4^m6 to 8^m2), extend about 1½ miles north-north-eastward from the northern end of the island, and a ridge of rocks and foul ground extends about the same distance south-westward from the island. North Button island bearing 037°, open south-eastward of Middle Button island, leads south-eastward of the shoals extending from the south-western end of this latter island. Good anchorage may be obtained southward of Middle Button island clear of the shoals.

Outram island, 3¼ miles southward of North Button island (*Lat.* 12° 19' N., *Long.* 93° 05' E.), is fringed by a reef, except on the western side.

Outram harbour is a deep indentation in the northern coast which affords good shelter from southerly winds. There are low rocks on the reefs which fringe West point, the western entrance point, and shoals with depths of less than 5 fathoms (9^m1), extend about three-quarters of a mile north-eastward from this point; shoals with depths of less than 5 fathoms (9^m1) also extend about 6 cables north-eastward from East point, the eastern entrance point of the harbour. Anchorage may be obtained, in a depth of 10 fathoms (18^m3), near the middle of the harbour, with West point in line with the north-eastern end of Middle Button island, bearing about 290°.

South Button island, about 3 miles southward of Middle Button island, is 118 feet (36^m0) high and formed of large rocks, steep-to all round. A rocky head, with a depth of 5½ fathoms (10^m1), lies about one mile eastward, and a coral patch, with a depth of 1¾ fathoms (3^m2), lies about one mile south-eastward of the islet.

Two Fathoms rock, with a depth of 2 fathoms (3^m7) over it, lies about one mile northward of the northern extremity of Wilson island (page 332). The northern point of Nicholson island, bearing 192°, and open westward of the western side of Wilson island, leads westward of this rock.

Tidal streams.—The tidal streams in Diligent strait are weak, but with strong southerly winds there is probably a considerable northerly set in the narrowest part of the strait between Wilson and Strait islands.

Directions.—Vessels approaching from northward, from a position about 2 miles eastward of North Button island, should shape course about 225° to pass half a mile north-westward, and about three-quarters of a mile westward, of South Button island; when South Button island bears about 035°, course should be altered southward

Charts 825, 830, 70,

Chart 1419.

until the southern side of South Button island is in line with the north-western extremity of Outram island, bearing 055°, when it should be brought and kept astern on that bearing; when the northern point of Nicholson island, situated about 5 miles southward of Cross point (page 329), is seen open westward of the western extremity of Wilson island, bearing about 192°, course may be shaped to pass about 1½ miles westward of Wilson island.

RITCHIES ARCHIPELAGO.—General remarks.—Ritchies archipelago consists of a group of about 10 islands which extend about 30 miles southward from the northern end of Outram island (page 331); the northern end of the group is separated from Baratang island by Diligent strait. The islands of the archipelago are all densely wooded and abound in pigeons and pigs; they are practically uninhabited except for a few natives who visit them in the fine weather.

North-western side of Ritchies archipelago.—Dangers.—The north-western side of Ritchies archipelago forms the south-eastern side of Diligent strait.

Charka juru is the strait which separates Outram island from Henry Lawrence island, about one mile southward of it; it has considerable depths in the fairway throughout. When using this channel a mid-channel course should be steered and care should be taken to avoid the coral heads and shoal ground, which extend about one mile southward from South point, the southern extremity of Outram island.

The western side of Henry Lawrence island rises steeply to a ridge, 567 feet (172^m8) high, and is bordered by a narrow reef on which are scattered mangroves.

Kwangtung strait separates Henry Lawrence island from John Lawrence island, south-westward of it, and is described on page 334.

Rocky heads lie about half a mile northward of Briton point (*Lat.* 12° 10' N., *Long.* 93° 02' E.), the northern extremity of John Lawrence island, and shoals and foul ground extend about 1½ miles north-westward from the north-western coast of that island.

Wilson island lies westward of the northern part of John Lawrence island, from which it is separated by a narrow channel; its summit, about one mile from its north-western point, is 710 feet (216^m4) high. The southern and eastern coasts of Wilson island are thickly fringed with mangroves, and foul ground, strewn with coral heads, extends from its north-western point to Briton point.

Western side of Ritchies archipelago.—Dangers.—Nicholson island lies south-south-westward of Wilson island, from which it is separated by a strait about 9 cables wide. It is hilly, its northern summit being 390 feet (118^m9) high. A white and prominent reef fringes its western side, from which it extends from one to 2 cables and is steep-to. Shoals with depths of less than 5 fathoms (9^m1) on them, extend about 3½ cables north-north-westward from the northern point of the island; the fringing reef extends about 3 cables southward from the southern point of the island, and close southward of the reef is a shoal with a depth of 1½ fathoms (3^m2) over it.

Peel (Sir William Peel) island is low and thickly fringed with mangroves; it lies about half a mile eastward of Nicholson island, being separated from it by a channel which is available for launches with local knowledge, and is separated from Wilson island, about half a mile

Charts 825, 830, 70.

Chart 1419.

northward of it, by a narrow channel much encumbered with rocks.

Tadma juru.—Dangers.—Directions.—Tadma juru, a narrow channel between Peel and Havelock islands, has considerable depths 5 in the fairway and was much used during the survey.

Rosamund shoal is a narrow ridge of coral heads, nearly awash and steep-to on its northern side; its southern end lies about half a mile northward of Stowe point, the northern extremity of Havelock island and the southern entrance point of Tadma juru. The shoal is usually 10 difficult to distinguish and the narrow channel between it and Peel island should not be attempted when entering Tadma juru.

Vessels approaching Tadma juru from westward should steer 090° to pass about 2 cables northward of Stowe point, and when about $1\frac{1}{2}$ cables from the south-western coast of Peel island, should alter 15 course southward to about 123° , keeping in mid-channel; when close to the eastern entrance to the strait, course should be shaped 073° towards the reef fringing the south-western side of John Lawrence island, which is steep-to and is usually visible; when close to the edge of this reef, course should be altered to about 147° , which leads 20 along the western edge of the reef and then eastward of Pilot reef, situated about one mile southward of the southern extremity of John Lawrence island (page 334). For directions for entering Tadma juru from southward or eastward, *see* page 334.

Western side of Ritchies archipelago (continued).—Coast.— 25 From Stowe point, the western coast of Havelock island trends south-westward for about $3\frac{1}{2}$ miles to Melville (Doone) point, the western extremity of the island; during the survey, good anchorage was obtained off Ja-lebar, situated about $2\frac{1}{4}$ miles south-south-westward of Stowe point (*Lat.* $12^{\circ} 03' N.$, *Long.* $92^{\circ} 58' E.$). 30

Between Melville point and the southern extremity of Havelock island, about $9\frac{1}{4}$ miles south-eastward, the south-western side of the island is fringed by reef which extends from about 2 to 4 cables offshore. There are two small bights, situated about 2 and 5 miles, respectively, south-eastward of Melville point, the south-eastern bight being named 35 Prince's inlet (Golung ma). White cliffs, about 90 feet (27^m4) high, form the southern extremity of the island. Sail rock, 20 feet (6^m1) high, situated about one cable off the southern end of the island, has the appearance of a sail when seen on some bearings.

Fusilier channel (Nankauri strait) and the islands farther southward, 40 are described on pages 334 and 335.

Eastern side of Ritchies archipelago.—Island and dangers.— The northern and western sides of Outram island and Charka juru, the channel separating it from Henry Lawrence island, are described on page 332. The eastern side of the island is fringed by a reef which 45 extends about 3 cables offshore. As stated on page 332, coral heads and foul ground extend about three-quarters of a mile southward from South point, the southern extremity of Outram island.

The eastern coast of Henry Lawrence island is low and indented, and is fringed by a dense belt of mangroves and fronted by a reef which, 50 in places, extends as much as one mile offshore; a thickly-wooded islet lies on this reef about 4 miles southward of South point, and the reef dries out for a short distance eastward of the islet.

East or Inglis island lies about three-quarters of a mile eastward of

Chart 1419.

the wooded islet on the reef ; there is a least depth of 6 fathoms (11^m0) in the fairway of the channel separating them. A reef which dries and is steep-to fringes all except the north-western coast of East island ; it extends as much as half a mile off the north-eastern coast, where it terminates in two rocks, about 4 feet (1^m2) high. Small portions of the northern and southern points of the island have been detached by the sea and appear as islets at high tide but are joined to East island by the drying reef.

- 10 Inglis shoals, two coral patches with depths of 3½ and 4½ fathoms (6^m9 and 8^m7) over them, are situated about three-quarters of a mile southward, and 1½ miles south-south-eastward, respectively, of the southern point of East island.

- Kwangtung strait, which separates Henry Lawrence and John Lawrence islands, has considerable depths in the fairway throughout, and the drying reefs which fringe either shore of the strait, are plainly visible.

- Anchorage, with good shelter from north-eastward, may be obtained in a depth of 7 fathoms (12^m8), off a sandy bight immediately north-westward of Wreck point, the southern extremity of Henry Lawrence island, situated about 3½ miles south-westward of East island.

- Tadma bay is entered between Runnymede point (*Lat.* 12° 03' N., *Long.* 93° 03' E.), the southern extremity of John Lawrence island, situated about 3 miles south-westward of Wreck point, and the southern extremity of Peel island, about 2½ miles farther westward ; it affords good anchorage, sheltered from north-eastward.

- Tadma bay forms the southern entrance to Paranga juru, a narrow channel separating John Lawrence and Peel islands, and also forms the eastern entrance to Tadma juru, separating Peel and Havelock islands, which is described on page 333.

Pilot reef, a 2½-fathom (4^m6) patch, lies about one mile southward of Runnymede point ; a narrow coral ridge on which the depths are less than 5 fathoms (9^m1), extends about one mile southward from Pilot reef.

- The eastern side of Havelock island is fringed by a reef, from the northern part of which foul ground extends as much as 1½ miles eastward to within a short distance of the ridge extending southward from Pilot reef.

- In order to pass eastward of Pilot reef, vessels from southward or eastward bound for Tadma bay or Tadma juru, should keep the western extremity of Sir Hugh Rose island (page 335), bearing 173°, and just open eastward of the eastern extremity of Neill island ; when the extremity of the reef extending southward from Runnymede point is seen, course may be altered north-westward into the bay.

- Off-lying dangers.**—Minerva patch, an isolated rocky patch with a least depth of 3½ fathoms (6^m9), is situated about 4½ miles east-south-eastward of Wreck point ; it lies near the outer edge of a bank which, with depths of less than 20 fathoms (36^m6), extends about 5 miles eastward from the southern end of Henry Lawrence island.

- Vibart shoal, with a least depth of 9 fathoms (16^m5) and steep-to on its eastern side, lies about 6½ miles south-eastward of Runnymede point.

Fusilier channel.—Fusilier channel (Nankauri strait), which separates Neill island from the southern end of Havelock island, is about 2½ miles wide and has considerable depths in the fairway, but a small coral patch with a least depth of 7 fathoms (12^m8), lies at its

Chart 1419.

western end, about 8 cables northward of the north-western point of Neill island; vessels are advised to pass on the northern side of this patch.

Neill and Sir Hugh Rose islands.—Dangers.—Neill island is 5
465 feet (141^m7) high at its north-eastern point, where there are some prominent white cliffs which rise steeply from the sea; a rock, about 20 feet (6^m1) high, lies about half a cable off this point. The northern coast of the island is fringed with reefs with some foul ground at the western end. Some detached patches, with depths of 4½ and 5 fathoms 10
(8^m7 and 9^m1), lie close off the foul ground. The southern coast of the island is low and is partly fringed with mangroves; it is fronted by a reef which extends as much as 4 cables from the southern extremity of the island and on which the sea breaks heavily. The south-western point of the island consists of dark-coloured cliffs about 40 feet (12^m2) 15
high, and is steep-to.

Sir Hugh Rose island (*Lat. 11° 47' N., Long. 93° 05' E.*), the southernmost island of the Ritchies archipelago, lies about 2 miles south-eastward of Neill island and is densely wooded; the highest point, which has an elevation of 240 feet (73^m2), is on its western side, and 20
there are some conspicuous yellow cliffs, about 80 feet (24^m4) high, at its north-eastern extremity. The island is fringed by a reef about one cable wide, from the eastern edge of which rocky ground, on which the sea breaks, extends about one cable farther eastward. A rocky bank on which the depths are less than 5 fathoms (9^m1), extends about 25
6 cables westward, and about 3 cables south-westward, from the island.

A shoal with a least depth of 3 fathoms (5^m5) at its northern end, lies about 1½ miles south-south-eastward of the south-western extremity of Neill island and about 9 cables from its southern coast. In 30
Arthur channel, the passage between Neill and Sir Hugh Rose islands, there are several patches with depths of from 4½ to 5½ fathoms (7^m8 to 9^m6), and, as the adjacent depths are very irregular, vessels are advised not to use Arthur channel.

Deep draught vessels, passing westward of Sir Hugh Rose island, 35
should avoid a 9-fathom (16^m5) bank, situated from 1½ to 2½ miles south-westward of that island.

ANDAMAN STRAIT.—General remarks.—Andaman strait, for its greater part, separates Baratang island from South Andaman island, westward of it, but at its western end it separates Middle 40
Andaman island from South Andaman island, *see* page 311. It has a least width of about 80 yards (73^m2) in places.

The narrow part of the strait has mostly moderate depths throughout, but one or two ridges, with a least depth of 3 fathoms (5^m5), over them, cross the strait. The bottom throughout is of mud and 45
sand.

Orol kaicha (*Lat. 12° 11' N., Long. 92° 46' E.*), an island situated about half-way through, where the trend of the strait changes from north and south to east and west, may be passed on either side, but the curves in the channel eastward and northward of the island are 50
more moderate.

A steam vessel with a draught of 13 feet (4^m0) has passed through this strait.

Chart 3145, plan of Eastern entrance to the Andaman or Middle strait.

Eastern entrance to Andaman strait.—Dangers.—The eastern entrance to Andaman strait lies between a 250-foot (76^m2) headland 5 (North point), the south-eastern extremity of Baratang island, and Point Dorrington (South point), the north-eastern extremity of South Andaman island, about 2 miles south-south-westward.

A small, isolated and rocky ledge with a prominent rock, 5 feet (1^m5) high on it, lies about half a mile south-eastward of the 250-foot (76^m2) 10 headland, and a detached shoal with a least depth of 1½ fathoms (2^m7) over it, lies about 4 cables southward of the same point.

From the 250-foot (76^m2) headland, the coast trends west-south-westward for about 1½ miles to North point, the northern point of the inner entrance to the strait; this stretch of coast is fronted by a coral 15 reef which dries in patches and extends as much as 5 cables offshore in places.

Entrance hill, a small conical hill 100 feet (30^m5) high, is situated immediately over North point and is a good mark.

A ledge of drying coral reef extends about half a mile north-eastward 20 of Point Dorrington, and between this point and the southern point of the inner entrance to the strait, about 1½ miles westward, the coast is fringed by a bank of dead coral, mud and stones which extends about 2 cables offshore in places.

A bar, over which there are depths of from 1½ to 2 fathoms (3^m2 to 25 3^m7), obstructs the entrance to the strait, between the coast about half a mile north-eastward of North point and Point Dorrington. The deep channel is only one cable wide with shoals extending from each shore, so that it is necessary to buoy the channel before entering.

Charts 839, 1419.

30 **EASTERN SIDE OF SOUTH ANDAMAN ISLAND.—Point Dorrington to Cape Diamond.—Coast.**—Between Point Dorrington and Cape Diamond (Wedge point), about 1½ miles southward, the coast is fringed by a reef which dries and extends as much as 2½ cables offshore. A rock, one foot (0^m3) high, lies about half a mile south- 35 eastward of Point Dorrington, and rocks which dry 3 and 4 feet (0^m9 and 1^m2), lie between 4½ and 6 cables northward of Cape Diamond and about 3½ cables offshore.

Chart 839.

40 Wedge rock, about 12 feet (3^m7) high, is situated about half a cable southward of Cape Diamond.

Off-lying dangers.—Smyth rock, the outermost danger off this part of the coast, is a pinnacle, with a depth of 2½ fathoms (4^m1) over it, rising abruptly from depths of 8 fathoms (14^m6); it lies about one mile eastward of Point Dorrington.

45 Whitehouse rock lies about one mile eastward of Cape Diamond, and has a least depth of 2 fathoms (3^m7) over it. Midway between Whitehouse rock (*Lat.* 12° 01' N., *Long.* 92° 48' E.) and Cape Diamond is a shoal with a least depth of 3 fathoms (5^m5) over it.

50 **Port Meadows.—Dangers.**—Port Meadows is entered between Cape Diamond and Cape Persain, about 11 cables south-westward. The shores of the port are fringed by coral reefs, and the surrounding land is mostly low with extensive tracts of mangroves, intersected by creeks and forming several islets.

Charts 1419, 825, 830, 70.

Chart 839.

The entrance is divided into two passages of nearly equal width by Duncan or Entry island, 260 feet (79^m2) high and densely wooded ; it lies on a bank on which the depths are less than 5 fathoms (9^m1), which is connected with the northern shore of the harbour close westward of Cape Diamond. A drying reef extends about 1½ cables northward from Duncan island, and the eastern and western sides of the island are fringed to a distance of about one cable with above-water and sunken rocks ; one of the former rocks, 18 feet (5^m5) high and a good mark, lies close off the south-western side of Duncan island, with a rock which dries one foot (0^m3), about three-quarters of a cable south-westward of it.

Cape Persain is the north-eastern extremity of a densely wooded hill, situated on a promontory separated from the main island by mangroves. The eastern side of the promontory is fronted to a distance of as much as 4 cables by a drying reef, but eastward and northward of Cape Persain, the reef only projects about one cable offshore and has on it some rocks which dry from 2 to 6 feet (0^m6 to 1^m8).

Off-lying danger.—The Patch, a shoal with a least depth of 3½ fathoms (6^m4) over it, lies about three-quarters of a mile east-south-eastward of Cape Persain.

Anchorage.—**Directions.**—Anchorage may be obtained, in depths of from 9 to 10 fathoms (16^m5 to 18^m3), about 2½ cables westward of the western point of Duncan island ; there is also anchorage in a depth of 8 fathoms (14^m6), in the centre of the south-western part of the harbour.

Vessels approaching the southern entrance should keep Cape Persain bearing 282°, until the eastern extremity of Duncan island is in line with Cape Diamond, bearing 017°, whence a mid-channel course should be shaped through the entrance.

Cape Persain to North point.—**Coast.**—**Kotàra anchorage.**—Between Cape Persain and Point Crawley, about 7 cables southward, and thence to Kotàra point, about 1½ miles farther south-westward, the coast is fronted by a drying reef on which are some above-water rocks ; a rock which dries 6 feet (1^m8) lies about 5½ cables east-south-eastward of Point Crawley.

The entrance to Kotàra anchorage lies between Kotàra point and the northern side of Kyd island, a rounded island, 780 feet (237^m7) high, about three-quarters of a mile southward. A drying reef extends between half a cable and 2 cables from the northern and eastern sides of Kyd island.

About one mile westward of Kotàra point, an arm branches northward and affords snug anchorage for small vessels, in depths of from 3½ to 5 fathoms (6^m4 to 9^m1), mud.

Charts 839, 1419.

Shoal bay, entered between the south-eastern side of Kyd island and Cape Masy (*Lat.* 11° 56' N., *Long.* 92° 48' E.), about 1½ miles south-eastward, is an inlet fringed with mangroves, which extends east-south-eastward for about 2½ miles and leads to Shoal Bay creek, a long and narrow creek extending southward between wooded hills. There is a depth of 3½ fathoms (6^m4) in the fairway of the entrance to Shoal bay, whence the depths decrease to 3 fathoms (5^m5) about 1½ miles within the entrance, and to one fathom (1^m8) at the entrance to Shoal Bay creek.

Charts 825, 830, 70.

Chart 1419.

Between Cape Masy and North point, the northern entrance point of Port Blair, about 14 miles southward, the coast is bold and free from dangers outside a distance of half a mile offshore; within the coast, the land rises to a broken ridge on which Koyob, situated about 6½ miles northward of North point, attains an elevation of 1,505 feet (458^m7).

Chart 514.

PORT BLAIR.—General remarks.—Port Blair, the entrance to which lies between North point and South point, about 2 miles southward, is an excellent landlocked harbour; Ross island, lying about 4 cables north-eastward of South point, divides the entrance into two channels in each of which there are considerable depths in the fairway. Port Blair is the headquarters of the Chief Commissioner, who is the representative of the Indian Government for the Andaman and Nicobar islands, and was formerly the headquarters also of a penal establishment which was closed down in 1945. The residence of the Chief Commissioner and the principal administrative offices are situated at Aberdeen, a village on the southern side of the harbour, about one mile west-north-westward of South point. The Port Officer also resides at Aberdeen.

Ross island.—Dangers.—Lights.—Ross island, the northern extremity of which lies about 1½ miles south-south-eastward of North point, is triangular in shape and extends about 7 cables south-south-westward from its northern point. Except for a small part of its western side, the coasts of the island are fringed by a reef which extends as much as 1½ cables offshore. A bank on which the depths are less than 3 fathoms (5^m5), extends about 3 cables north-westward from the north-western point of the island.

Near the northern extremity of the island is a dark stone building with battlements, about 56 feet (17^m1) in height. A light is exhibited, at an elevation of 163 feet (49^m7), from a steel framework structure, 56 feet (17^m1) in height, situated on the north-eastern corner of this building.

A jetty, suitable only for small boats, extends a short distance north-westward from the north-western extremity of Ross island, and a wooden pier extends westward from the coast about three-quarters of a cable southward of the jetty. A wharf, which is used for berthing by the ferry launches, lies close southward of the wooden pier.

A light is exhibited from the wharf, and also from the head of the wooden pier; in 1951, both these lights were reported to be extinguished.

The former residence of the chief Commissioner is situated on the highest part of the island, about 2¼ cables eastward of the wooden pier, with which it is connected by a road.

Entrance channels.—Lights.—Dangers.—Beacons.—A drying reef fringes North point, and outside it a bank on which the depths are less than 3 fathoms (5^m5), extends about 1¾ cables southward from the point.

Leading lights for the northern entrance are situated near Atalanta point (*Lat.* 11° 40' N., *Long.* 92° 46' E.), situated about three-quarters of a mile north-north-westward of South point. The front light is exhibited at an elevation of 70 feet (21^m3), from a white tower, 7 feet

Charts 1419, 1398, 825, 830, 70.

Chart 514.

(2^m1) in height, situated about 2 cables westward of Atalanta point ; the rear light is exhibited, at an elevation of 144 feet (43^m9), from a white tower, 7 feet (2^m1) in height, situated about 1½ cables south-westward of the front light. These two white towers are surmounted 5 by large white crosses, which by day, make them good marks ; when in line, bearing 214°, they lead through the northern entrance.

A large and prominent building, formerly a jail, is situated close within Atalanta point. Atalanta point beacon, a white iron framework structure surmounted by a cross, 12 feet (3^m7) high, stands on the 10 edge of the reef which fringes the point and extends about one cable offshore.

Sesostris shoal consists of two coral patches, the outer of which lies in the approach to the southern entrance channel, about 8½ cables south-south-eastward of South point and about half a mile offshore ; 15 it has a least depth of 13 feet (4^m0). The inner patch, lying about 1½ cables west-south-westward of the outer, has a least depth of 12 feet (3^m7). Atalanta point beacon bearing 314°, and in line with a beacon situated about one cable northward of Command point, *see* below, leads north-eastward of Sesostris shoal (*Lat.* 11° 39' N., *Long.* 92° 46' E.). 20

Sesostris bay lies on the south-western side of the southern entrance channel, between South point and Atalanta point ; the bay is nearly filled with reef, and an 18-foot (5^m5) patch lies on the line joining the two entrance points, about 2½ cables south-south-eastward of Atalanta point. A beacon, the charted position of which is approximate, stands 25 about half a cable westward of South point, and about one cable north-north-westward of the beacon is a pier. The head of this pier bearing 169°, and in line with the charted position of the beacon, leads through the southern entrance channel, between Atalanta point and the shoal bank extending north-westward from the north-western point of Ross 30 island.

A light is exhibited from the head of each of two piers which extend from the shore of the north-western part of Sesostris bay ; in 1951, these lights were reported to be extinguished.

Northern side of outer part of the harbour.—Dangers.— 35
Buoys.—Beacon.—North bay lies on the northern side of the harbour immediately westward of the entrance ; it is entered between North point and Perseverance point, about 8 cables south-westward. The shores of the bay are fringed by a coral reef which extends as much as 1¾ cables from its western side, while the head of the bay is fronted to 40 a distance of about 2 cables by a drying sand flat. A red conical buoy, surmounted by a staff, is moored about 1¾ cables southward of the south-eastern extremity of Perseverance point.

About half a mile west-north-westward of Perseverance point, Lime Kilns pier extends a short distance in a west-south-westerly direction ; 45 a house, with a white roof which makes it a good mark, stands about one cable northward of the pier.

Semiramis bay is entered between Lime Kilns pier and Command point, about 4½ cables west-north-westward ; a pier extends southward from the head of the bay. Command point is 171 feet (52^m1) high, and 50 about one cable within its extremity is a small whitewashed building which is prominent ; on the top of the building is a beacon in the shape of a cross.

Mount Harriet, with some buildings close to its summit, rises to an

Charts 1419, 1398, 825, 830, 70.

Chart 514.

elevation of 1,193 feet (363^m6), about 1½ miles northward of the head of Semiramis bay.

Command bay, at the head of which is the settlement of Hope Town, 5 lies on the western side of Command point. A coaling quay, known as Hope Town wharf, lies about one cable north-westward of Command point; the quay has a length of about 315 feet (96^m0), and depths of from 20 to 24 feet (6^m1 to 7^m3) alongside. A black mooring buoy is moored about one cable north-westward of the coaling establishment 10 and, in order to keep clear of the fringing reef, vessels must lie about 10 feet (3^m0) from the end of the wharf, at which distance there is a depth of 30 feet (9^m1).

About one mile westward of Command point (*Lat.* 11° 42' N., *Long.* 92° 44' E.), is Shore point, the western entrance point of Bamboo 15 Flat bay, at the head of which are some buildings. There is a small jetty about 1½ cables east-north-eastward of the extremity of Shore point. A detached shoal with a depth of 16 feet (4^m9) over it, lies on the western side of the entrance to Bamboo Flat bay, about 3½ cables east-north-eastward of Shore point.

20 **Southern side of outer part of the harbour.—Danger.—Buoys.**—From Atalanta point, the southern shore of the harbour trends westward for about 8 cables to Phoenix point, the eastern entrance point of Phoenix bay; about half a cable southward of Phoenix point are two lighter jetties, the southern of which has depths alongside of 6 feet 25 (1^m8) and is equipped with a 5-ton crane.

A small jetty, which in 1945 was reported to have a depth alongside of 5 feet (1^m5), extends northward from the shore about 2½ cables westward of Atalanta point.

The western entrance point of Phoenix bay, situated about 4 cables 30 west-north-westward of Phoenix point, is fronted by Blair reef which extends about 4 cables east-north-eastward from the point and on which there are some rocks, one and 2 feet (0^m3 and 0^m6) high. A white conical buoy, surmounted by a cylinder and fitted with a reflector, is moored close off the north-eastern extremity of Blair reef. 35 Blair point, about 4 cables west-north-westward of the western entrance point of Phoenix bay, is fringed by a reef which extends about 1½ cables offshore. Chatham island, about a quarter of a mile northward of Blair point, is connected with it by a causeway, partly constructed of wood. There are some buildings on Chatham island and 40 two jetties extend from its northern and south-western sides, respectively; the head of the northern jetty is about 280 feet (85^m3) long, with depths alongside of from 20 to 24 feet (6^m1 to 7^m3).

Two black cylindrical mooring buoys are moored about three-quarters of a cable off the northern side of Chatham island.

45 The north-eastern extremity of Chatham island bearing 293°, and in line with the extremity of Shore point, leads north-eastward of Blair reef.

Inner part of the harbour.—Danger.—Buoys.—Westward of Chatham island the harbour turns southward, and from Blair point the 50 coast trends south-westward for about 6 cables to Hood point, and thence southward for about three-quarters of a mile to Navy point, forming the eastern side of the inner harbour. Navy bay lies between Navy point and Lewis point, about 9 cables south-south-westward.

Mangrove bay is entered between Shore point and the coast about

Charts 1419, 1398, 825, 830, 70.

Chart 514.

6 cables west-south-westward ; it is filled with a shoal bank, the inner part of which dries and on which there are mangroves. Brigade creek, a rambling creek between mangroves, is entered at the head of the bay by a channel passing close to the eastern shore. A white conical buoy marking the western side at the entrance to this channel, is moored about $1\frac{1}{4}$ cables southward of the extremity of Shore point. 5

Ranger flat, on which the depths are less than 3 fathoms (5^m5), extends about $4\frac{1}{4}$ cables south-south-eastward and $4\frac{1}{2}$ cables eastward, from Shore point (*Lat.* $11^{\circ} 42' N.$, *Long.* $92^{\circ} 43' E.$). Two white buoys, each surmounted by a cylindrical topmark, are moored about $2\frac{1}{4}$ and $5\frac{1}{4}$ cables, respectively, westward of Chatham island and mark the southern side of Ranger flat. The northern extremity of Chatham island bearing 085° and in line with Perseverance point, leads southward of the flat. 15

From the western entrance point of Mangrove bay, the western side of the inner harbour curves in a slight bight to Dundas point, about 11 cables south-south-eastward, and thence trends south-westward for about 2 miles to Tapping point, south-westward of which the harbour becomes shallow. Viper island, on which are several buildings which formerly were part of the penal establishment, lies in a slight bight between Dundas and Tapping points. 20

Anchorages.—Prohibited anchorages.—The best anchorage berth is about half a mile west-south-westward of Chatham island, in depths of from 42 to 48 feet (12^m8 to 14^m6), mud, with the north-western extremity of Chatham island bearing 068° , well sheltered from all winds. 25

An anchorage often used in fine weather is westward of Ross island, in depths of about 50 feet (15^m2), sand, in a position between one and 2 cables south-westward of the jetty, but this anchorage is not very safe in bad weather. 30

In November, 1917, H.M.S. *Northbrook* anchored with Atalanta point beacon bearing 289° , distant about $3\frac{1}{4}$ cables.

Owing to the existence of telegraph cables, vessels are prohibited from anchoring in the area between the pecked lines indicated on the chart south-westward of Ross island. 35

Anchorage is prohibited in the vicinity of a telegraph cable which crosses the inner harbour in a westerly direction from a position about a quarter of a mile southward of Hood point and the position of which is indicated on the chart. 40

Directions.—Vessels from northward bound for the inner harbour should pass about half a mile northward of Ross island, and thence about a quarter of a mile southward of Perseverance point, and about a similar distance northward of Blair reef. Course should then be shaped to pass in mid-channel between Chatham island and Command point, and the north-western end of Chatham island rounded at a distance of about one cable, whence course may be shaped as necessary for anchoring. 45

If bound for the anchorage westward of Ross island, vessels should keep the light-towers situated close westward of Atalanta point, in line, bearing 214° ; when the pierhead and the beacon on South point come into line, bearing 169° , they should be steered for on that bearing, and when the jetty on the north-western extremity of Ross island bears 090° , course may be altered eastward as necessary for anchoring. 50

Chart 514.

Vessels from southward using the southern entrance channel should keep Atalanta point beacon bearing 314° , and in line with the beacon on a building on Command point, until the beacon on South point comes
 5 in line with the head of the pier about one cable northward of it, bearing 169° , when course should be altered northward and these marks kept in line astern, which leads in the fairway between Atalanta point and Ross island; when the northern extremity of Ross island bears 090° , course may be altered westward to pass midway between Blair reef
 10 and Perseverance point, and thence, as directed above.

If bound for the anchorage westward of Ross island, vessels should approach the southern entrance channel as directed above, and when South point bears 186° , course should be altered northward and the point kept on that bearing, astern, which leads to the anchorage.

15 **Settlement.—Port facilities.**—Port Blair was occupied by the Japanese from March 1942 to October 1945, when it was re-occupied by the Government of India. Prior to 1942, the buildings of a convict penal settlement were situated around the harbour with the administrative headquarters on Ross island. The penal settlement was
 20 abolished in 1945, and the residence of the Chief Commissioner and all official residences and offices are now situated in Aberdeen village (*Lat. $11^{\circ} 40' N.$, Long. $92^{\circ} 45' E.$*), a short distance westward of Atalanta point.

The port is healthy as the forest in its immediate vicinity has been
 25 cleared. In 1949, the population, which is based on freed convicts from India and Burma, was approximately 18,000. There is a Government hospital at Aberdeen village.

No coal is available and only small stocks of liquid fuel are maintained for local use.

30 Provisions of all kinds are imported and are therefore scarce at all seasons.

Fresh water can be supplied to vessels at anchor by a water boat at a rate of about 20 tons per hour.

There is a Government tug of 220 horse-power at Port Blair.

35 Minor repairs to vessels can be undertaken. There are 2 patent slips in Phoenix bay, details of one of which are given in Appendix I. In 1949, it was reported that both slipways were unserviceable and required repair.

There is a concrete seaplane slipway which extends between high
 40 and low water marks; the slip is reported to be about 64 feet (19^m5) long and 66 feet (20^m1) wide.

There is a 5-ton steam crane on the jetty at Phoenix point.

The principal exports are timber, coconuts and copra and the chief imports, food stuffs and piece goods from India.

45 There is regular sea communication with Madras and Calcutta.

Storm and weather signals.—The general system, *see* pages 30 to 32, is in use at Port Blair.

Climatic table.—*See* page 81.

Chart 1398.

50 **EASTERN SIDE OF SOUTH ANDAMAN ISLAND** (*continued*).—**South point to Chiriya tapu.**—**Coast.**—From South point, the eastern coast of South Andaman island trends south-south-westward for about $11\frac{1}{2}$ miles to Chiriya tapu; this stretch of coast is bold

Charts 825, 830, 70.

Chart 1398.

and, except for Sesostris shoal (page 339), is clear of dangers outside the fringing reef, which in places extends about 3 cables offshore.

Chiriya tapu, the southern extremity of South Andaman island, and the north-eastern entrance point of Macpherson strait, is the southern end of a distinctive bare promontory, at the base of which are some caves. A rock, one foot (0^m3) high, lies about half a mile westward of the point; vessels should not attempt to pass between the point and this rock. 5

Macpherson strait and the anchorage north-westward of Chiriya tapu, have been described on page 318. 10

Rutland island.—The aspect and western side of Rutland island have been described on page 319.

Portman bay is an inlet on the eastern side of the island, about 4½ miles south-south-westward of Chiriya tapu. The depths are irregular in the middle of the bay, and there is shallow water and a mangrove swamp at its head; a heavy swell sets into the bay during the North-east monsoon. 15

Rocks, both above-water and sunken, extend some distance off the southern coast of Rutland island, and this coast should be given a berth of 1½ miles except at the eastern end where it is clear of dangers outside a distance of half a mile offshore. 20

Investigator rock (*Lat.* 11° 20' N., *Long.* 92° 37' E.), situated off the western end of the south coast of Rutland island, has been described on page 319. 25

ISLANDS AND PASSAGES AT THE SOUTHERN END OF THE ANDAMAN ISLANDS.—**Manners strait.**—Manners strait lies between the southern end of Rutland island and Cinque islands, about 3 miles south-eastward. There are considerable depths in the fairway of the passage and tide rips occur across the strait. Manners strait is used by power vessels. 30

Cinque islands.—**Anchorage.**—Cinque islands are two hilly islands, almost joined by a rocky ledge which dries about 7 feet (2^m1). The trees on both islands are remarkably contorted, due to the South-west monsoon. 35

The northern Cinque island has two peaks, 529 and 569 feet (161^m2 and 173^m4) high, which form a saddle near its northern point; at its southern end is a small conical and bare hill, 293 feet (89^m3) high, from which a promontory projects west-north-westward.

The southern Cinque island terminates southward in Cone hill, a conical knoll, 410 feet (125^m0) high. 40

There is anchorage, in depths of from 7 to 10 fathoms (12^m8 to 18^m3), dead coral and sand, in Minto bay, westward of the drying ledge which nearly joins the two islands, with the western extremity of the northern island bearing 349°. Anchorage has also been obtained off the western side of the southern Cinque island, in depths of 13 fathoms (23^m8), with Cone hill bearing about 168°, distant about one mile; this anchorage should be approached from westward. 45

Passage island and The Sisters.—Passage island, situated about 3½ miles south-south-westward of the southern Cinque island, is 351 feet (107^m0) high at its northern end; the southern end is low. A detached rock, 6 feet (1^m8) high, lies about 3 cables northward of the northern end of Passage island, and a bank with a least depth of

Chart 1398.

6 fathoms (11^m0) over it, lies about 2 miles west-south-westward of the same point ; the bank consists of a narrow rocky ridge fringed with sand, over which there are overfalls at spring tides.

- 5 There are considerable depths in the channel between Cinque islands and Passage island, but there are tide rips in it at spring tides.

The Sisters are two islets lying close together about 3½ miles south-eastward of Passage island. The north-eastern and larger islet is 306 feet (93^m3) high, and both islets lie on a bank on which there are
10 depths of from 5 to 10 fathoms (9^m1 to 18^m3), coral ; a rocky spit, part of which dries, extends about 7 cables north-westward from the islets.

Duncan passage.—Dangers.—Duncan passage lies between The Sisters and North Brother island, situated about 10 miles south-south-westward. It is the main channel between South Andaman and Little
15 Andaman islands, but it has not been surveyed.

A shoal, over which a depth of 5 fathoms (9^m1), sand, was obtained by R.I.M.S. *Elphinstone* in 1902, and which appeared to be crescent-shaped, was reported to lie about 2½ miles north-north-eastward of North Brother island, but the general depths in the passage, are believed
20 to be from 12 to 20 fathoms (21^m9 to 36^m6), sand, so that anchorage may be obtained if necessary.

Tidal streams.—Current.—In light breezes and fine weather, the tidal streams set eastward and westward in Duncan passage, but sometimes a current caused by the winds runs through it.

- 25 **The Brothers.—Dangers.**—The Brothers consist of North Brother (*Lat.* 10° 59' N., *Long.* 92° 41' E.) and South Brother, two flat-topped wooded islands, the tops of the trees on each island being about 90 feet (27^m4) high ; South Brother lies about 4 miles south-westward of North Brother, and large numbers of grey pigeons breed
30 on it. Each island has a lagoon in the middle.

North Brother island is fringed by a reef which extends about half a mile north-westward from it. Between North Brother and South Brother is Leeboard ledge, a detached shoal, the position of which is approximate. Vessels should not pass between the two islands.

- 35 A reef, which is awash and usually breaking, was reported, in 1879, to extend from 1½ to 2 miles north-north-westward of South Brother island, with foul ground between them, which also extends about 5 miles west-north-westward from the island. Another reef was also reported, in 1879, to extend about 1½ miles south-eastward from the
40 island.

Little Andaman island lies about 4½ miles south-westward of South Brother island. Ariel ledge and other dangers lie in this passage, which should not be used.

- In 1899, S.S. *Onipenta* reported striking a rock or wreck about
45 8 miles west-north-westward of South Brother island.

Chart 825.

- South Sentinel island.—Anchorage.**—South Sentinel island, which is uninhabited, has a level summit and a low point on its southern side, situated about 23 miles westward of South Brother island ; the
50 tops of the trees are about 144 feet (43^m9) high, and the island has much the same appearance on all bearings. It lies near the south-eastern end of a bank, with depths of less than 20 fathoms (36^m6) over it.

The western side of the island is the most shelving, and anchorage

Charts 825, 830, 70.

Chart 825.

can be obtained, in a depth of 14 fathoms (25^m6), with the island bearing 281° distant 8 cables.

There are practically no shoals outside the fringing reef which surrounds the island; landing can only be effected on its northern side, and in fine weather. 5

Turtle are plentiful here, and there are great numbers of robber crabs.

There are considerable depths in the channel between South Sentinel island and Little Andaman island about 14 miles south-eastward. 10

Little Andaman island.—Off-lying danger.—Little Andaman island, which is the southernmost of the Andaman group, is well wooded, about 600 feet (182^m9) high in the centre and inhabited. From a distance the island appears nearly level, rising gradually from both ends towards its summit. See caution on page 22. 15

Chart 1398.

Bumila creek (*Lat. 10° 53' N., Long. 92° 31' E.*) lies on the northern side of Little Andaman island. The land at the northern end of the island is low, and the creek cannot be identified until close off the entrance, which then shows as a gap in the trees. 20

Anchorage may be obtained by vessels with local knowledge, about 4 cables northward of the entrance to the creek, in a depth of 8 fathoms (14^m6), dead coral, with the centre of the entrance bearing 158°. The anchorage should be approached from north-westward, in which direction there are no known dangers; off the north-eastern coast of the island, towards the Brothers, there are irregular shallow depths. 25

A coral reef, on which the sea usually breaks, extends nearly across the entrance to Bumila creek; the channel, round the western end of this reef, has depths of from 7 to 8 feet (2^m1 to 2^m4) in it.

The tidal streams set about 080° and 135° at the anchorage off Bumila creek, and there is sometimes a strong stream flowing out of the creek. 30

Chart 825.

Jackson creek, on the western side of Little Andaman island, entered about 9 miles south-westward of Bumila creek, can be identified by a conspicuous square clump of trees that falls abruptly to the water's edge. A reef appears to extend northward for three-quarters of a mile from the western entrance point of the bay into which Jackson creek debouches, and there is anchorage, in a depth of about 7½ fathoms (13^m7), about one mile north-north-eastward of the entrance to the creek. On the north-eastern side of the bay there are some remarkable cliffy sandstone islands, hollowed with caves. In 1922, it was reported that the natives at Jackson creek were numerous and friendly. 40

The coast between Jackson creek and Sandy point, also known as Point Alcock, the south-western point of Little Andaman island, 16 miles southward, appears to be fringed by a coral reef with a sandy beach. Just southward of Jackson creek the coast is cliffy. 45

Api islet, close offshore, about 9 miles southward of the entrance to Jackson creek, is prominent. At the south-eastern extremity of Little Andaman island, about 9 cables eastward of Sandy point, a reef which dries 4 feet (1^m2), extends about 6 cables offshore. 50

Good landing may be effected southward of Kwáte-tu-Kwage, situated about one mile southward of a creek in Hut bay, an open light on the eastern side of Little Andaman island.

Charts 830, 70.

Chart 825.

Off-lying dangers.—Dalrymple bank is a coral bank situated about 9 miles westward of Sandy point. The least known depth near the middle of the bank is $5\frac{1}{2}$ fathoms (10^m1), where there are ridges of rock, but less depths may exist, and the bank should not be crossed, especially during the South-west monsoon, when there are heavy rollers on it. There are depths of over 30 fathoms (54^m9) from 3 to 4 miles westward of the middle of the bank.

In 1951, a shoal with a depth of 6 fathoms (11^m0) over it, was reported in a position about $15\frac{1}{2}$ miles south-westward of the middle of Dalrymple bank.

Chart 830.

Ten Degrees channel.—Ten Degrees channel, lying between Little Andaman island and Car Nicobar, about 77 miles southward, is deep and clear of dangers.

Chart 825.

ISLANDS AND DANGERS EASTWARD OF ANDAMAN ISLANDS. — **Narcondam island.** — Narcondam island, about 73 miles eastward of Cape Price (page 307), is an extinct volcano, 2,330 feet (710^m1) high, shaped like a truncated cone; several small above-water rocks lie close around it, outside which there appear to be considerable depths. In 1946, the island was reported to lie in a position about $2\frac{1}{4}$ miles farther westward than charted.

There is reported to be an anchorage one cable westward of a large rock on the north-north-western side of the island, which also gives some shelter for landing. Landing is both difficult and dangerous, except during the calm weather of February and March. Barata bay, on the eastern side of the island, has a shingle beach, on which there is no surf in very calm weather; it is the best landing place on the island, but there is no anchorage off it. The bay may be known by the groves of palm trees.

Barren island.—**Anchorage.**—Barren island (*Lat.* $12^\circ 16' N.$, *Long.* $93^\circ 51' E.$), about 43 miles eastward of Outram island of the Ritchies archipelago (page 331), is 1,158 feet (352^m9) high, with densely wooded cliffs rising sheer from the water's edge. The crater near the centre of the island, is old and choked, its outer slope being covered with foliage; on the western side, the crater wall is broken down and permits a view of the interior, and a thin column of steam issues from a sulphur bed on the side and near the summit of the cone. There are no dangers within half a mile of the island.

Chart 825, plan of Barren island anchorage.

There is anchorage, in a depth of about 15 fathoms (27^m4), about 2 cables off a beach on the south-western side of the island; here the tidal stream at half flood has been observed running south-eastward at a rate of $2\frac{1}{2}$ knots.

Landing may be effected in a nook formed by an outflow of lava through the gap in the crater wall. A hot spring trickles through the beach near the landing place; except for this, the water of which is just palatable when cooled, there is no water on the island during the dry season.

Large flocks of wild goats and many pigeons were seen when the island was visited by R.I.M.S. *Minto* in April, 1922. The island is infested with rats.

Charts 825, 830, 70.

Chart 825.

Invisible bank.—Invisible bank, which is extensive, lies about 47 miles eastward of the Cinque islands. Near the centre of the bank there is an area, with depths of less than 20 fathoms (36^m6); the water over the bank does not appear discoloured.

Flat rock (*Lat.* 11° 08' N., *Long.* 93° 31' E.), which is awash, lies southward of the central part of the bank, near the southern end of an area about 5 miles long which is the shallowest part of Invisible bank, and on which the depths are less than 10 fathoms (18^m3).

Chart 840.

NICOBAR ISLANDS.—General remarks.—The Nicobar islands, which extend about 160 miles in a south-south-easterly direction from Car Nicobar, the northernmost island, are usually divided into the northern, central and southern groups. The northern group consists of Car Nicobar and Batti Malv islands; the southern group of Great 15 and Little Nicobar with their off-lying islets; and the central group includes all the remaining Nicobar islands. Of the 19 Nicobar islands, 12 are inhabited, the total population being about 12,000 of which about 9,000 reside on Car Nicobar. The islands are a dependency of the Andamans and are administered by an Assistant Commissioner 20 who resides on Car Nicobar. Between 1942 and 1945, the islands were occupied by the Japanese and Car Nicobar was developed by them as a supply base.

For further general remarks on the Nicobar islands, *see* page 22.

Tidal streams.—Currents.—Within a few miles of the Nicobar 25 islands, the tidal stream usually sets north-eastward with the rising tide and south-westward with the falling tide; the streams attain a rate of from 3 to 4 knots in the channels between the islands.

In the offing of the Nicobar islands, the current usually sets with the prevailing wind, but it is variable both in rate and direction; its rate 30 has been sometimes found to reach 50 miles a day.

Chart 830.

Heavy overfalls were reported in 1919 about 110 miles west-south-westward of the southern end of Great Nicobar island.

Chart 840.

NORTHERN GROUP OF NICOBAR ISLANDS.—Car Nico- 35 bar.—General remarks.—Car Nicobar, the northernmost Nicobar island, is thickly covered with trees, mainly coconut palms. The island is almost circular in shape with an indentation at Sáwi bay, on its north-western side; the highest ridge, which has an elevation of 40 about 200 feet (61^m0) is in the south-western part of the island. The northern and north-western points of Car Nicobar should not be approached closely as foul ground extends from them.

The Car Nicobarese are friendly and cheerful compared with the inhabitants of the Andaman and other Nicobar islands. In 1945, the 45 population of the island was 8,732, including a sprinkling of Indian traders from the Andamans. There are about 15 villages on Car Nicobar, of which Mús, situated close south-eastward of the northern extremity of the island, and Malacca, on the eastern coast, about 5 miles south-south-eastward of Mús, are the principal ones. 50

Coconuts form the only medium of barter in the island and are the only export.

Charts 830, 70.

Chart 840.

Caution.—In 1945, all beacons on the island were reported to be missing.

Climatic table.—See page 82.

5 Chart 840, plan of Sawi bay.

Sáwi bay.—**Dangers.**—**Beacon.**—**Anchorage.**—Sáwi bay is entered between Keating point, the northern extremity of Car Nicobar (chart 840), and Hog point, about $3\frac{3}{4}$ miles south-westward; foul ground extends about one mile northward from Keating point and 10 about 4 cables northward from Hog point.

In 1887, a coral patch with a least depth of $5\frac{1}{2}$ fathoms (10^m1) over it, was reported by H.M.S. *Mariner* in a position about $6\frac{1}{2}$ cables north-westward of the observation spot, and a 5-fathom (9^m1) patch lies about $8\frac{1}{2}$ cables west-north-westward of the same point. The 15 observation spot is situated on a small promontory projecting west-north-westward from the coast, about $1\frac{1}{2}$ miles southward of Keating point (Lat. $9^\circ 15' N.$, Long. $92^\circ 46' E.$).

A beacon, consisting of a white mast surmounted by a white diamond, stands on the north-western extremity of the promontory containing 20 the observation spot; although not conspicuous, the beacon is reported to be a useful mark when making the anchorage, but see caution above.

Anchorage may be obtained, in a depth of 12 fathoms (21^m9), coral rock, covered by a thin layer of sand, about three-quarters of a mile northward of Sáwi village, situated about 9 cables eastward of Hog 25 point. Anchorage may also be obtained in a depth of about 11 fathoms (20^m1), about half a mile west-north-westward of the observation spot, with Keating point bearing 027° , and Hog point bearing 240° ; vessels should approach this berth from west-south-westward, keeping southward of the shoal patches which lie north-westward of it. In February, 30 1887, H.M.S. *Arab* found the best anchorage berth to be closer inshore off the observation spot, in a depth of 7 fathoms (12^m8).

There is good landing for boats at low water on the northern side of the promontory on which is the observation spot.

Off Sáwi bay, the tidal stream sets north-eastward with the rising 35 tide.

Chart 840.

Western side of Car Nicobar.—**Coast.**—**Anchorage.**—From Hog point, the western side of Car Nicobar trends southward for about $5\frac{1}{2}$ miles to Foul point, the south-western extremity of the island.

40 Anchorage may be obtained, in depths of from 9 to 11 fathoms (16^m5 to 20^m1), about half a mile off Arong, a village about 3 miles southward of Hog point. Vessels should approach the anchorage with the village bearing 090° . Landing is practicable in fine weather, but care is necessary as the channel between the rocks is only 20 feet 45 (6^m1) wide. It is reported that local fishermen can always beach their craft, except during the South-west monsoon.

Southern side of Car Nicobar.—**Anchorage.**—**Tidal streams.**—Kémios bay, on the southern side of the island, about $2\frac{1}{2}$ miles eastward of Foul point, affords anchorage during the North-east monsoon.

50 Landing may be usually effected at any time of the year; Kémios village, which is fronted by a beach, lies close westward of a well-defined entrance to a creek. A reef, extending in an easterly and westerly direction, is reported to lie about $1\frac{1}{2}$ cables seaward of the low-water-line.

Charts 830, 70.

Chart 840.

Trading vessels anchor, in depths of from 10 to 12 fathoms (18^m3 to 21^m9), about midway between Kémios village and another village situated close eastward of the well-defined entrance to the creek.

The tidal streams in Kémios bay are regular and strong ; the stream sets east-south-eastward with the rising tide at a rate of about 3 knots at springs, and in the opposite direction during the falling tide. 5

The village of Kákana is situated about 4½ miles eastward of Foul point and about 2 miles south-westward of the south-eastern extremity of the island. There is no recognised anchorage here but sea-going dhows usually lie about a quarter of a mile offshore. There are two beaches where landing may be effected ; they are reported to provide safe landing near the time of high water, but local knowledge is necessary. 10

Chart 840, plan of Mús anchorage.

Eastern side of Car Nicobar.—Coast.—Anchorages.—Mús, the principal village on Car Nicobar and the residence of the Assistant Commissioner, is situated about three-quarters of a mile south-eastward of Keating point. Anchorage may be obtained off Mús, in a depth of 9 fathoms (16^m5), with Keating point bearing 292°, about 4 cables offshore ; the village lies at the head of a small inlet. During the South-west monsoon, a swell which renders landing difficult, sets on to the beach. The tidal streams at the anchorage are reported to reach a rate of 4 knots at springs and vessels there are liable to drag their anchors. 15 25

Chart 840.

From Mús (*Lat.* 9° 15' N., *Long.* 92° 46' E.) the coast trends south-eastward for about one mile to the village of Lopáte (Lápate). Anchorage may be obtained about half a mile offshore north-eastward of Lopáte. Anchorage can also be obtained abreast the villages of Tamálu and Perka, situated about 4½ and 5 miles, respectively, south-south-eastward of Keating point, in depths of 14 fathoms (25^m6), about 1½ miles offshore ; landing may be effected at these villages in ordinary monsoon weather. 30

Malacca.—Aspect.—Anchorage.—At Malacca, a village situated at the southern end of a slight bight in the coast, about half a mile southward of the village of Perka, there is a small concrete jetty about 470 feet (143^m3) long and 12 feet (3^m7) wide ; at low water the jetty dries out completely, but at high water springs, boats of 4 feet (1^m2) draught can comfortably berth on its southern side about 40 feet (12^m2) from its head, care being taken, when approaching, to avoid a number of concrete posts which extend eastward of the jetty head. The jetty provides the best means of discerning the place from seaward but, in poor visibility, two groups of bee-hive-shaped huts, situated close northward and southward, respectively, of the jetty, stand out more clearly against the jungle-covered foreshore. A tall flagstaff was reported, in 1948, to stand about a cable northward of the jetty. About 80 yards east-south-eastward of the jetty head a small beacon, painted black and white, existed in 1945, and marked the edge of the southern reef, between which and the jetty there are no obstructions. About 50 yards northward of the jetty a dangerous reef extends seaward. 35 40 45 50

Safe landing for boats under oars, clear of rocks and coral, is obtainable on the beach close southward of the jetty ; except at high

Chart 840.

water, power boats should not attempt to approach close to this beach.

- Anchorage can be obtained off Malacca, in depths of from 15 to 20 fathoms (27^m4 to 36^m6), with fair protection from the South-west monsoon; a vessel can approach with the flagstaff bearing 254°, or with the jetty bearing 248°, and anchor when the required depth is obtained; there are depths of more than 40 fathoms (73^m2) outside a distance of between 3 and 4 cables offshore, when they begin to decrease.
- In clear weather the breakers on the reefs northward and southward of the anchorage can easily be seen.

Landing is reported to be more easily effected at Malacca than at Mús, as there is a narrow passage between the sandbanks in which there is no swell.

- Tidal streams.**—The tidal streams around Car Nicobar are rapid, and cause tide races, particularly northward of the island.

From about 6 to 8 miles eastward of the island, in the month of February, a south-westerly set at a rate of 7 knots has been experienced about 1½ hours after high water.

- Batti Malv island.**—Batti Malv island (*Lat. 8° 50' N., Long. 92° 51' E.*), about 17 miles south-south-eastward of Car Nicobar, is low near the coast at its north-western end, whereas, on its western, southern and south-eastern sides, the rocks rise perpendicularly from the sea; from a distance it appears wedge-shaped. The upper portion is thickly wooded.

Reefs appear to extend half a mile from the north-western and south-western sides of the island.

Indifferent anchorage may be obtained north-westward of the island, but the landing is bad. The island is uninhabited.



Batti Malv island from about 5 miles
north-north-eastward.

(Original dated 1952.)

- CENTRAL GROUP OF NICOBAR ISLANDS.**—**Chowra island.**—**Anchorage.**—**Tidal streams.**—Chowra island, situated about 23 miles south-south-eastward of Batti Malv island, is low generally, but its southern end rises almost vertically in a rocky pinnacle to an elevation of about 343 feet (104^m5), having the appearance with the contiguous low portion, of a flap hat, whence it was named Sombbrero by the early Portuguese navigators.

- Sánénnya, situated on the north-eastern coast of the island, is the principal village and at one time was the capital of the Nicobar islands. Chowra island has a local importance on account of possessing the only cooking-pot manufacturing industry in the Nicobars, and also for the knowledge of its inhabitants in the building of dug-out canoes. In 1931, the population was about 600 and it was reported in 1946 to have increased to over 1,000.

- Reefs are reported to extend about 1½ miles north-westward from the northern part of the western coast of Chowra island.

Charts 830, 70.

Chart 840.

Anchorage may be obtained in depths of from 9 to 10 fathoms (16^m5 to 18^m3), abreast Sánénia village, about half a mile offshore. Indifferent anchorage may also be obtained at Hiwäh or Raichafé, a village about three-quarters of a mile south-eastward of Sánénia; 5 landing is possible at Hiwäh, but only by the use of local craft.

In the vicinity of Chowra island, the tidal stream sets north-eastward during the rising tide and south-westward during the falling tide.

Off-lying danger.—A coral bank, the limits of which have not been determined, lies between $2\frac{1}{2}$ miles north-westward, and 4 miles 10 north-north-westward, of the northern point of Chowra island.

Tillanchong island.—**Anchorages.**—**Dangers.**—Tillanchong island, which is uninhabited, lies with Cape Winifred, its southern extremity, about 34 miles eastward of Chowra island; it is long and narrow, extending about $9\frac{1}{2}$ miles northward between Cape Winifred 15 and Cape Maud, its northern extremity, with an average width of less than half a mile, its greatest width being about $1\frac{1}{4}$ miles near the middle of the island. Its coasts are steep and rise to a jagged ridge which culminates in Maharáni peak, 1,058 feet (322^m5) high, situated about midway between the northern and southern extremities 20 of the island.

Paíra rock, 282 feet (85^m9) high, lies about half a mile north-westward of Cape Maud (*Lat.* $8^\circ 35' N.$, *Long.* $93^\circ 36' E.$), and several detached rocks lie within half a mile of other parts of the island.

A chain of needle-like rocks extends in a curve between Cape Winifred and the Isle of Man, a rock 404 feet (123^m1) high and the largest 25 of the chain, situated at its south-eastern extremity, about $2\frac{3}{4}$ miles south-eastward of Cape Winifred.

An unexamined shoal, with a depth of 11 fathoms (20^m1) over it, lies about $9\frac{1}{2}$ miles south-westward of Cape Winifred. 30

Chart 840, plan of Castle bay.

Castle bay, lying on the western side of Castle Bay point, situated about 3 miles north-north-eastward of Cape Winifred, affords fair anchorage in fine weather, in a depth of 15 fathoms (27^m4), with Castle Bay point bearing 062° , distant $5\frac{1}{2}$ cables. 35

A rock, awash, lies about 3 cables southward of Castle Bay point, and shoal patches, on which the depths are less than 5 fathoms (9^m1), extend about $4\frac{1}{2}$ cables southward from the point.

There is deep water between the rock, awash, and Castle Bay point, and the rock can be seen in a good light, but care is necessary to avoid 40 it and the shoal patches southward of it when entering the bay.

Landing may be effected on the northern shore of the bay, and there is a freshwater lake on its western side, about $4\frac{1}{2}$ cables westward of the anchorage.

Chart 840.

Anchorage has also been obtained off Novára bay, an open bight on the western side of the island, about 3 miles southward of Cape Maud. 45

Tillanchong island is visited occasionally by natives from Chowra island and also from Bompoka island, about 25 miles west-south-westward of Cape Winifred. 50

Teressa island.—**Anchorages.**—Teressa island, which is crescent-shaped and sparsely inhabited, lies with its northern point about $6\frac{1}{2}$ miles south-eastward of Chowra island. From a distance it appears like two islands, its central part being considerably lower than the

Chart 840.

northern or southern parts. Reefs extend from its northern, western and southern sides, especially from the last named. It is not advisable to visit the island during the South-west monsoon.

- 5 Hinán (Hinám), a village situated near the middle of the western coast, is only visible from seaward on north-easterly bearings. Anchorage may be obtained by vessels with local knowledge, close inshore off Hinán, in depths of from 6 to 14 fathoms (11^m0 to 25^m6).

Landing is not always practicable even during the North-east monsoon, but when it is unsafe to land at Hinán, landing can often be effected through an opening in the reef off Laksi, a village consisting of a few huts, about 4 miles south-eastward of Hinán. Laksi is not easily identified from seaward as it lies amongst trees; anchorage in a depth of 14 fathoms (25^m6), coral and coarse sand, may be obtained south-south-westward of the village, about half a mile outside the coastal reef.

The village of Bengála is situated on the eastern side of the island, about 2 miles southward of its north-eastern extremity. Anchorage can be obtained about 4½ cables offshore abreast this village, with the north-eastern extremity of the island bearing 006°, the eastern extremity bearing about 146°, and the northern extremity of Bompoka, *see* below, bearing 115°. This berth is not a safe anchorage although there is a good landing place at Bengála (*Lat.* 8° 19' N., *Long.* 93° 07' E.).

25 Bengála. The village of Keráwa is situated about 3½ miles southward of Bengála. There is no safe anchorage off this village and a depth of 27 fathoms (49^m4) is here found about a quarter of a mile offshore.

Bompoka island.—Bompoka island lies about 1½ miles north-eastward of the southern end of Teressa island, being separated from it by a deep channel. There are a few inhabitants.

30 Anchorage may be obtained by vessels with local knowledge off Póahat, on the western side of the island, in a depth of 14 fathoms (25^m6), about a quarter of a mile offshore, with the village in line with the northern peak of the island, bearing 040°; the depths decrease rapidly and caution is necessary when anchoring.

35 **Kamorta island.**—**Off-lying shoal.**—Kamorta (Camorta) island lies with Horace point, its northern extremity, about 16½ miles eastward of the southern point of Bompoka island, and about 12½ miles south-south-westward of Cape Winifred (page 351). Nancowry island lies close southward of, and overlaps, the southern end of Kamorta island, and between them is the fine landlocked Nancowry harbour. Kamorta island is picturesque owing to the alternations of forest and grassy slopes, with white coral beaches backed by coconut palms. There are villages and huts along the coast on both sides of the island, and on its southern extremity, about 13 miles southward of Horace point, is a hill, 720 feet (219^m5) high.

45 The unexamined patch described on page 351, lies about 6 miles north-north-westward of Horace point.

Western side of Kamorta island.—**Horace point to Wasp point.**

—**Coast. — Danger.** — From Horace point the western coast of Kamorta island trends south-westward for about 5 miles, and thence southward for about 7½ miles to Wasp point, the northern entrance point of Expedition harbour. The village of Koi-hóa is situated on the coast about 3½ miles south-westward of Horace point, and the entrance to Dring harbour, which can only be entered by boats, lies

Chart 840.

about $2\frac{1}{4}$ miles northward of Wasp point. About one mile northward of Wasp point is a tree-covered hill.

The coast between Horace point and Wasp point is fringed by a reef which, between the former point and Koi-hóa village, extends about half a mile offshore. Between the village and the western extremity of the island, about $1\frac{1}{2}$ miles south-westward, the reef projects about 2 miles north-north-westward and is known as Perseus reef. Southward of the western extremity of the island, the reef, which there extends about one mile offshore, gradually becomes narrower.

Caution.—Off the western coast of Kamorta island, dangers may exist in depths of less than 10 fathoms (18^m3).

Anchorage.—On account of the bad holding ground, there are no good anchorages off the western coast of Kamorta island for vessels with local knowledge, but anchorage may be obtained almost anywhere off the coast northward of Wasp point, in depths of from 10 to 20 fathoms (18^m3 to 36^m6); southward of the entrance to Expedition harbour, it is advisable to anchor in depths of over 20 fathoms (36^m6).

Anchorage in depths of from 7 to 9 fathoms (12^m8 to 16^m5), may be obtained off Koi-hóa village about one mile offshore, but no protection is afforded here by Perseus reef during the South-west monsoon.

Vessels with local knowledge may obtain anchorage off the entrance to Dring harbour, in a depth of $9\frac{1}{2}$ fathoms (17^m4), about $6\frac{1}{2}$ cables from the southern entrance point, with that point bearing 089° and in line with a 209-foot (63^m9) hill near the head of the harbour, which has a steep fall on its north-eastern side. This is perhaps the best anchorage off this coast as little or no current is experienced here.

Tidal streams.—Between Perseus reef (*Lat.* $8^\circ 11' N.$, *Long.* $93^\circ 25' E.$) and a point between the entrances to Expedition and Nancowry harbours, the tidal stream sets southward with the rising tide and northward with the falling tide. At springs the north-going stream is the stronger, attaining a rate of 3 knots at a distance of from 2 to 3 miles from the coast; the south-going stream runs at a rate of from three-quarters of a knot to $1\frac{1}{4}$ knots. At neaps, the north-going stream runs at a rate of from three-quarters of a knot to $1\frac{1}{4}$ knots, and the south-going stream from one-quarter to three-quarters of a knot.

Tide rips occur frequently at springs in various places all along the coast at variable distances from the coast.

Chart 841.

Expedition harbour.—**Caution.**—Expedition harbour is a land-locked harbour which opens out within into Grand harbour; it is separated from Nancowry harbour, southward of it, by a low, narrow peninsula.

Owing to the incomplete nature of the survey, chart 841 should be used with caution.

Owing to the swarms of mosquitoes, which infest vessels anchored in Expedition harbour, vessels intending to make a protracted stay are advised to do so in Nancowry harbour.

There are depths of from 7 to 13 fathoms (12^m8 to 23^m8) in the entrance, which is about half a cable wide, between the reef that extends about $1\frac{1}{2}$ cables south-westward from Wasp point (*Lat.* $8^\circ 00' N.$, *Long.* $93^\circ 29' E.$), and Satellite point, on the southern side; the latter point is almost free from dangers but foul ground extends about

Chart 841.

1½ cables north-eastward from Pinnacle point, situated about one cable east-south-eastward of Satellite point.

The southern and eastern sides of the harbour have not been surveyed. Close northward of, and about midway between, the line joining Devil's point, situated on the western side of the harbour, about 4½ cables north-north-eastward of Wasp point, and Edgcumbe point, about 3½ cables east-south-eastward of Devil's point, is Middle reef. About a quarter of a mile east-south-eastward of Edgcumbe point is Hoau (Ho-Ho) village. A coral patch, with a depth of 9 feet (2^m7) near its outer end, extends about 3½ cables south-eastward from Foul point, a point on the western side of the harbour situated 5½ cables northward of Devil's point (*Lat. 8° 04' N., Long. 93° 29' E.*). ❧

Anchorage.—Directions.—Anchorage may be obtained by vessels with local knowledge, in a depth of 10 fathoms (18^m3), mud, with Devil's point bearing 340°, distant 3½ cables.

Vessels without local knowledge, wishing to enter Expedition harbour, are advised to wait until the sun is high and, if possible, to enter at low water, when all off-lying dangers will be visible. Vessels should approach the entrance either from northward or southward, by steering along the coast at a distance of at least one mile from it, and when Hoau village opens out in the entrance, and bears 071°, steer in on that bearing; this passes close to Satellite point and avoids the foul ground extending about 1½ cables north-eastward from Pinnacle point. When Devil's point bears 000°, course may be shaped for the anchorage as convenient.

Vessels are advised not to proceed above Devil's point, into Grand harbour, unless the northern end of Middle reef has been previously buoyed, and then only when the sun is high.

Satellite point to Reef point.—Coast.—From Satellite point, the western coast of Kamorta island trends southward for about 2½ miles to Reef point, the southern extremity of Kamorta island and the northern entrance point of the western entrance to Nancowry harbour; the fringing reef remains comparatively narrow along this stretch of coast.

Chart 840.

Eastern side of Kamorta island.—Coast.—Anchorage.—From the north-eastern point of Kamorta island, situated about 1½ miles eastward of Horace point, the eastern side of the island curves south-south-westward and then south-south-eastward in a wide bight for about 8½ miles, and thence trends southward for about 3½ miles to Naval point, the south-eastern extremity of Kamorta island and the northern entrance point of the eastern entrance to Nancowry harbour. The whole of this stretch of coast is fringed by a reef which extends from half a mile to three-quarters of a mile offshore, except off Moshóit village, situated on the northern side of the bight, about 4 miles south-south-westward of the north-eastern point of the island, where it extends as much as one mile offshore; the coastal reef is readily seen in a good light.

Vessels with local knowledge may obtain anchorage about 2 cables north-eastward of the coastal reef which extends off Moshóit village, with the north-eastern point of Kamorta island bearing 014°, and the northern extremity of Trinkat island, bearing 132°.

Trinkat island.—Trinkat island lies between one and 2½ miles

Chart 840.

eastward of the southern part of Kamorta island, being separated from it by Beresford channel, which is believed to be blocked by reefs and sandbanks. The island is very low and level, and contains numerous coconut palms. Morrel (Morrell) point, its southern extremity (*Lat.* 5
8° 02' N., *Long.* 93° 35' E.), lies about 2½ miles eastward of Naval point.

Anchorage is sometimes obtained, in depths of 8 or 9 fathoms (14^m6 or 16^m5), between the northern part of Trinkat island and Kamorta island, but local knowledge is necessary on account of the numerous reefs in the vicinity. 10

Chart 841.

NANCOWRY HARBOUR AND APPROACHES.—General remarks.—Nancowry harbour is commodious and sheltered from all winds; it is situated between the southern side of Kamorta island and the northern side of Nancowry island, the latter island being 15 densely wooded. It has two entrances with considerable depths in each, and both entrances can be entered or left without difficulty in either monsoon. Both entrances can be distinguished from a considerable distance seaward.

Within the entrances, the harbour consists of four bays:—Fort or 20 Octavia bay and Satellite bay on the northern side, and Spiteful and Wasp bays on the southern side. Cross harbour is the area between Fort bay on the north, and Spiteful bay on the south.

The climate in Nancowry harbour is hot and damp, and malignant malaria is very prevalent. 25

Western entrance.—Dangers.—The western entrance lies between Reef point (page 354) and Man point, about a quarter of a mile east-north-eastward, on the north, and Burleigh rock, about 2½ cables south-eastward of Reef point, and Indian point, the north-western extremity of Nancowry island, situated about 2 cables north-eastward 30 of Burleigh rock, on the south; there is a least depth of 6 fathoms (11^m0) in the fairway of the entrance, which is about one cable wide between the dangers on either side.

Reef point has a whitewashed mark on it and would otherwise be very difficult to distinguish, but this mark is not to be relied on. Man 35 point is also difficult to identify, but a point which lies about 8 cables north-north-eastward of it, can be identified by a perforated rock at its extremity, which is visible either from eastward or westward, and by a small palm tree on the point.

Northbrook patch, with a least depth of 2½ fathoms (4^m1) over it, 40 lies about a quarter of a mile south-south-westward of Reef point, with other shoal patches between it and the coast westward of the point.

Burleigh rock, 24 feet (7^m3) high with a wooded summit, is connected with the coast south-eastward by a reef; foul ground extends about three-quarters of a cable north-westward from the rock. 45

Approaches to eastern entrance.—Dangers.—Anchorage.—The approach to the eastern entrance lies between Morrel (Morrell) point, the southern extremity of Trinkat island, on the north-east, and Laire and Reid points, two points on the north-eastern coast of Nancowry island, situated about 1½ miles and one mile, respectively, 50 south-eastward of Naval point, on the south-west. Trinkat island, low-lying, level and densely wooded, is readily distinguished from Kamorta island, which is higher and more open.

Charts 840, 830, 70.

Chart 841.

Between Laire and Reid points, the north-eastern coast of Nancowry island is fronted by an extensive reef which extends as much as 5 cables offshore ; except at high water and on exceptionally calm days, the edge of this reef is marked by breakers.

A shoal with a least depth of $2\frac{3}{4}$ fathoms (5^m0) over it, lies on the edge of the shorebank, on which the depths are less than 5 fathoms (9^m1), about 4 cables east-north-eastward of Reid point.

Eastern shoal, which consists of several patches with depths of less than 5 fathoms (9^m1), lies on the north-eastern side of the approach channel, the outermost patch, which has a least depth of $4\frac{1}{4}$ fathoms (7^m8), lying about $11\frac{1}{2}$ cables eastward of Reid point and about $8\frac{1}{2}$ cables south-westward of Morrel point (*Lat.* $8^\circ 02' N.$, *Long.* $93^\circ 35' E.$).

Sheltered anchorage, in depths of 12 fathoms (21^m9), good holding ground, may be obtained close eastward of the eastern entrance, with Naval point bearing 270° , distant about one mile, but a good scope of cable is necessary as the squalls off the land are heavy.

Eastern entrance.—Dangers.—Beacon.—The eastern entrance lies between Naval point on the north, and the coast between Reid point and Mayo point, about 11 cables westward, on the south ; there is a least depth of 6 fathoms (11^m0) in the fairway of the entrance, which is about $1\frac{1}{2}$ cables wide between the dangers on either side.

A bank on which the depths are less than 5 fathoms (9^m1), fringes the coast between Reid point and Mayo point, and extends as much as $2\frac{1}{2}$ cables offshore northward of Jub point, which lies midway between Reid and Mayo points. Depths of $2\frac{1}{4}$, $1\frac{1}{2}$ and $1\frac{3}{4}$ fathoms (4^m1 , 2^m7 and 3^m2) extend about $1\frac{1}{2}$ cables north-north-eastward, northward and north-north-westward, respectively, from Mayo point.

On the northern side of the entrance Naval point is fringed by a reef, and depths of less than 5 fathoms (9^m1), extend as much as $3\frac{1}{4}$ cables east-south-eastward, and about $2\frac{1}{4}$ cables southward, from the point ; a white iron framework beacon, 17 feet (5^m2) high and surmounted by a white ball, marks the edge of the reef about $2\frac{1}{4}$ cables southward of Naval point.

There are several other dangers in and near the entrance, the positions of which may best be seen on the chart.

Western part of Nancowry harbour.—Dangers.—Beacon.—Wasp bay, which forms the south-western part of Nancowry harbour, lies between the western entrance and a line drawn from Easter point, situated about 11 cables north-north-eastward of Man point, and Leda point, about $1\frac{1}{4}$ miles east-north-eastward of Easter point. Itoë village stands on the eastern shore of the bay about 6 cables southward of Leda point, and is a good mark.

On the western side of the bay, a $3\frac{3}{4}$ -fathom (6^m9) patch lies about half a mile north-north-eastward of Man point and about 2 cables offshore, and a shoal with a least depth of $3\frac{1}{4}$ fathoms (5^m9), lies about $2\frac{1}{4}$ cables east-south-eastward of Easter point.

On the eastern side of the bay, a rock which dries about 6 feet (1^m8), lies about 11 cables south-south-westward of Leda point and about $3\frac{1}{2}$ cables offshore.

Alfrey shoal, over which there is a depth of $5\frac{1}{4}$ fathoms (9^m6), lies nearly in mid-channel, about $5\frac{3}{4}$ cables west-south-westward of Leda point.

A white, iron, framework beacon, 24 feet (7^m3) in height, and sur-

Chart 841.

mounted by a ball, is situated about $1\frac{1}{2}$ cables westward of Leda point, and marks the edge of a reef fringing that point.

Satellite bay, the north-western part of Nancowry harbour, is entered between Easter point and Alfred point, about $1\frac{1}{2}$ miles north-eastward. Satellite patch, lying about midway between the entrance points, has a least depth of $2\frac{1}{2}$ fathoms (4^m1), rock. Several shoals, with depths of from 3 to 5 fathoms (5^m5 to 9^m1), lie in the southern part of the bay in positions which can best be seen on the chart, and in the northern part of the bay, the depths are irregular. 5 10

Eastern part of Nancowry bay.—Jetty.—Dangers.—Fort or Octavia bay, the north-eastern part of Nancowry harbour, is entered between Alfred point and Naval point, about $1\frac{1}{2}$ miles eastward; a disused watch tower stands about one cable north-westward of Naval point (*Lat. $8^{\circ} 02' N.$, Long. $93^{\circ} 32' E.$*). Ray point is situated about 15 half a mile west-north-westward of Naval point, and Battery point lies about $1\frac{1}{2}$ cables farther north-westward; a flagstaff stands about $1\frac{1}{2}$ cables north-eastward of Ray point, and about a similar distance northward of Battery point is a conspicuous clump of casuarina trees.

A stone jetty with a wooden extension at its head, lies about 3 cables 20 west-north-westward of Naval point. The jetty is about 390 feet (118^m9) long, and the wooden extension projects about 120 feet (36^m6) westward from the stone jetty head. The depths alongside the wooden extension are about 13 feet (4^m0) at its head, decreasing to about 2 feet (0^m6) at the eastern end. There are also two wooden jetties in Fort 25 bay.

The residence of the Government Agent is situated near the root of the stone jetty.

Spiteful bay, the south-eastern part of Nancowry harbour, is entered between Leda point and Mayo point, about 8 cables east-north-eastward. 30 There is a mudbank which dries 3 feet (0^m9) at the head of the bay, and there are detached reefs in its inner part; this bay should not be entered unless the reefs in it have been buoyed previously. There is a good landing place at Enounga village, which is situated on the eastern shore of the bay about a quarter of a mile southward of Mayo 35 point.

Anchorage.—Fort bay is clear of dangers and affords excellent anchorage in a depth of about 12 fathoms (21^m9), mud, with the conspicuous casuarina clump bearing about 075° , distant $3\frac{1}{2}$ cables. This anchorage is well sheltered and little current is experienced; it is open 40 to the sea breeze.

The most convenient anchorage in Spiteful bay is in the middle of its entrance, in a depth of about 12 fathoms (21^m9), which position is open to the sea breeze.

Good anchorage is reported to be obtainable in the fairway of the 45 eastern entrance to the harbour, on a line joining the stone jetty and the village of Mala, situated about $1\frac{1}{2}$ cables south-south-westward of Mayo point.

Tidal streams.—The tidal stream sets eastward with the rising tide and westward with the falling tide; the streams attain considerable strength in the entrances though they are weak inside the harbour. 50

Directions.—*Western entrance.*—From a distance of about 5 miles seaward, the western entrance can be identified by a high ridge of hills, and by the trend of the coast forming the southern side of the harbour.

Chart 841.

In order to avoid the dangers off Reef point which terminate in Northbrook patch, vessels should approach the western entrance from south-westward, keeping the conspicuous casuarina clump near Battery point bearing about 036° and open south-eastward of Man point, which leads south-eastward of Northbrook patch; when Reef point bears 000° , it should be steered for on that bearing until Burleigh rock bears 090° , when course should be altered gradually eastward, avoiding the foul ground which extends north-westward from Burleigh rock, and course shaped to pass midway between Man and Indian points.

The tidal streams run strongly between Man and Indian points, and it is advisable to have good steerage way on as there are many eddies which may give vessels a slew, which can then be checked by a quick movement of the wheel.

After passing Man point, vessels should keep Itoë village bearing 055° until Easter point bears about 305° , when course should be altered northward, passing close westward of Alfrey shoal; when Mayo point bears about 080° and is open northward of Leda point, course should be altered eastward, and the flagstaff north-eastward of Ray point should be steered for bearing 055° , which leads between the dangers extending from Leda and Alfred points.

Eastern entrance.—Vessels approaching the eastern entrance should keep Reid point (Lat. $8^{\circ} 02' N.$, Long. $93^{\circ} 32' E.$) bearing 280° and in line with Alfred point, which leads southward of Eastern shoal; when the right tangent of Trinkat island (chart 840) bears 034° , course should be altered northward to about 310° , and a red cliff with a mangrove clump close eastward of it, situated on the eastern side of Kamorta island about one mile northward of Naval point, steered for on that bearing, which leads north-eastward of the reef fronting the coast between Laire and Reid points; when Mayo point bears 261° , course should be shaped about 268° to pass about three-quarters of a cable southward of the beacon on the reef fringing Naval point, keeping clear of the shoals extending northward from the coast between Jub and Mayo points.

Communications.—There is sea communication with Port Blair every 6 months and occasionally with Rangoon and Penang.

*Chart 840.***CENTRAL GROUP OF NICOBAR ISLANDS** (*continued*).—

Katchall island.—**Dangers.**—**Anchorage.**—Katchall island lies about 4 miles south-westward of Kamorta and Nancowry islands, being separated from them by Revello channel. The island attains an elevation of 835 feet (254^m5) in the middle, and is covered with forest. The depths off the western coast of the island are very irregular, and there are some 9- and 10-fathom (16^m5 and 18^m3) patches about 3 miles off this coast.

West bay, a large bight on the south-western side of the island, is foul in its inner part, but vessels with local knowledge may obtain anchorage in a depth of 9 fathoms (16^m5), about one mile south-south-westward of its north-western entrance point; good landing may be effected inside the north-western entrance point of the bay. A south-westerly swell is reported to set into the bay sometimes during the North-east monsoon.

Tidal streams attain a rate of 2 knots across the entrance to the bay.

Charts 830, 70.

Chart 840.

South bay lies on the western side of Cape Albany, the southern extremity of Katchall island; it is encumbered with rocks and foul ground and should not be entered. In 1945, Cape Albany was reported to extend about 2 cables farther southward than charted. 5

The depths in East bay, on the eastern side of the island, are reported to be irregular, varying from 5 fathoms (9^m1) to no bottom at 20 fathoms (36^m6); a shoal, over which there is a least depth of 1½ fathoms (2^m7), lies about one mile north-westward of the south-eastern entrance point of East bay. 10

Chart 840, plan of Hoinipoh bay.

Hoin-ipoh bay, a slight bight on the eastern coast of Katchall island, close southward of East bay, affords good anchorage in a depth of 8 fathoms (14^m6), with Hoin-ipoh village bearing 259°, distant 3 cables. This bay is much frequented by vessels trading with the 15 island.

Chart 840.

Revello channel.—Dangers.—Revello channel is free from known dangers, with the exception of a 6-fathom (11^m0) shoal reported in 1921 to lie about midway between the northern extremity of Katchall island 20 and the western entrance to Nancowry harbour, and a 10-fathom (18^m3) patch, the exact position of which is doubtful, reported in 1923 by R.I.M.S. *Elphinstone* to lie about 2 miles eastward of the south-eastern entrance point of East bay.

A reef of drying rocks extends about one mile south-eastward from 25 Cape Connaught (*Lat.* 7° 55' N., *Long.* 93° 34' E.), the southern extremity of Nancowry island, situated about 7½ miles east-north-eastward of Cape Albany.

SOMBRERO CHANNEL.—Dangers.—Sombrero channel, which separates the central and southern groups of the Nicobar islands, lies 30 between Katchall and Nancowry islands on the north, and Little Nicobar island on the south. The depths in the channel are irregular but considerable in mid-channel.

A patch with a depth of 12 fathoms (21^m9), yellow clay, lies in the western approach to Sombrero channel, about 12 miles west-south- 35 westward of Cape Albany, and other shoal patches may exist in the vicinity.

A detached coral bank with depths of from 9 to 17 fathoms (16^m5 to 31^m1), is situated in the northern part of Sombrero channel, its northern edge being about 3 miles south-south-eastward of Cape Albany; 40 in 1917, this bank was reported by H.M.S. *Fantome* to be spreading westward.

Tidal streams.—In Sombrero channel, the tidal stream sets north-westward with the rising tide, and south-eastward with the falling tide; the streams are reported to attain a rate at springs of as much 45 as 5 knots in places.

SOUTHERN GROUP OF NICOBAR ISLANDS.—Little Nicobar island.—Off-lying islets and dangers.—Sombrero point, the northern extremity of Little Nicobar island, lies about 30 miles south-south-eastward of Cape Albany. Little Nicobar island is 50 mountainous, the most elevated parts being Empress peak, 1,420 feet (432^m8) high, and Mount Deoban, 1,428 feet (435^m2) high, situated

Chart 840.

about $5\frac{1}{2}$ miles south-south-eastward, and 7 miles southward, respectively, of Sombrero point. The island is covered with dense forest and there is much swamp.

- 5 Meroe (Miroe) islet, which is low, is situated about $10\frac{1}{2}$ miles west-north-westward of Sombrero point; landing on this islet is only practicable in the finest weather. Trak and Treis islets lie about 5 and 4 miles, respectively, west-north-westward of Sombrero point, and there are sunken rocks in the vicinity of these islets.
- 10 A rock with a depth of less than 6 feet (1^m8) over it lies about mid-way between Treis islet and Sombrero point.

Anchorage.—Anchorage in a depth of 6 fathoms (11^m0), may be obtained about three-quarters of a mile north-eastward of Trak islet, but the bottom here is uneven and the tidal streams are strong.

- 15 **Western side of Little Nicobar island.**—**Danger.**—**Anchorage.**—The north-western coast of Little Nicobar island between Sombrero point and Pahuā, about 6 miles south-westward, and the western coast thence to Cape Edinburgh, the southern extremity of the island, about $7\frac{1}{2}$ miles southward of Pahuā, is fringed by coral reef which
- 20 extends not more than half a mile offshore.

Chart 840, plan of Pulo Milo.

Pulo Milo, an islet fringed with coral reef, lies in a bight formed between Sombrero point and Pahuā, about $2\frac{1}{2}$ miles south-westward of the former point.

- 25 A 3-fathom (5^m5) patch lies in the channel between Pulo Milo and the coast of Little Nicobar, about 5 cables eastward of the northern end of Pulo Milo.

Anchorage may be obtained in the channel between Pulo Milo and the coast, in depths of from 9 to 13 fathoms (16^m5 to 23^m8), sand and

30 coral. This anchorage is well sheltered and is accessible in all winds. Landing can be effected on the eastern side of Pulo Milo, and on the coast of Little Nicobar abreast the islet.

Chart 840.

- North-eastern side of Little Nicobar island.**—**Anchorage.**—
- 35 At Iléyha (Iléya) (*Lat. $7^\circ 25' N.$, Long. $93^\circ 42' E.$*), a village of some 50 inhabitants about $1\frac{1}{2}$ miles south-south-eastward of Sombrero point, landing can be effected on a sandy beach either northward or southward of the village; close eastward of this village is a small drying coral patch.

- 40 Menchál island lies about 4 miles south-eastward of Sombrero point and about $1\frac{1}{2}$ miles from the north-eastern coast of Sombrero island; depths of $6\frac{1}{2}$ fathoms (11^m9) have been obtained in the channel between them, but there are probably less depths.

During fine weather, anchorage may be obtained by vessels with

45 local knowledge, in depths of from 6 to 7 fathoms (11^m0 to 12^m8), about half a mile south-westward of Menchál island, but the tidal streams are reported to be very strong here.

South-eastern side of Little Nicobar island.—The south-eastern side of Little Nicobar island is comparatively steep-to and is

50 free from off-lying dangers. This coast forms the north-western side of St. George's channel which separates Little Nicobar from Great Nicobar, and is described below.

Great Nicobar island.—**Off-lying islet.**—**Danger.**—Great Nicobar, the southernmost of the Nicobar islands, lies with Murray

Chart 840.

point, its northern extremity, about 10 miles south-south-eastward of Menchál island. The island is mountainous with three marked ranges, the mountains of which are steep-sided and covered with dense jungle. The main range attains in Mount Thuillier, situated in the north-eastern part of the island, an elevation of 2,105 feet (641^m6), and runs southward parallel with the eastern coast of the island to near South (Galathea) bay, close to its southern extremity. A second ridge runs westward from Mount Thuillier, reaching an elevation of 1,835 feet (559^m3).

Near the centre of the main ridge, a third range with a known elevation of 1,333 feet (406^m3), extends south-westward across the island. Between these ranges there are a number of broken ridges, which, in general, run north and south.

The western coast of the island, being open to the South-west monsoon, has not been examined.

In 1941, the inhabitants, who belong to the Shompen tribe of the Nicobarese, numbered only about 50.

Kabra islet, 309 feet (94^m2) high, is situated about 3 miles northward of Murray point; a shoal with a depth of 2½ fathoms (4^m6), was reported in 1886 to lie about 1½ miles north-eastward of Murray point, but its position is doubtful.

Chart 840, plan of St. George's channel.

St. George's channel.—Tidal streams.—St. George's channel, lying between Little and Great Nicobar islands, has a least width of about 4 miles between Cape Edinburgh and the north-western extremity of Great Nicobar island. There are considerable depths in the channel but they are irregular; the northern side is free from off-lying dangers, but the southern side, which is formed by the northern coast of Great Nicobar, is fringed with reef, and there are some patches as much as 1½ miles offshore.

The tidal streams, which here are strong, set fairly through the channel, setting north-eastward with the rising tide and south-westward with the falling tide.

Ganges harbour.—Dangers.—Ganges harbour, which is formed by a bight in the northern coast of Great Nicobar, is entered between a point (*Lat.* 7° 14' N., *Long.* 93° 48' E.) about 2½ miles west-south-westward of Murray point, and a point about 2¾ miles farther west-south-westward.

A coral head with a depth of less than 6 feet (1^m8) over it, and the position of which is approximate, lies about 1½ miles northward of the eastern entrance point of the harbour, and a spit with a depth of 3½ fathoms (6^m4) at its outer end, extends about 9 cables west-south-westward of the same point. A reef which fringes the western entrance point extends as much as 4 cables north-north-eastward from the point.

A shoal on which there are two rocks with less than 6 feet (1^m8) over them, lies nearly midway between the entrance points; between this shoal and the dangers extending from either entrance point, there are considerable depths.

Anchorage may be obtained in Ganges harbour, in depths of from 9 to 16 fathoms (16^m5 to 29^m3), coarse sand and clay.

Kondul island.—Caution.—Anchorages.—Kondul island is situated about 3 miles westward of the western entrance point of Ganges harbour and about one mile from the northern coast of Great Nicobar

Chart 840, plan of St. George's channel.

island. The northern part of the island is lofty and rocky, but safe landing may be obtained on its eastern side.

Unless with local knowledge, caution is necessary in approaching
5 Kondul island and the adjacent coast, as unknown dangers may exist. In 1921, R.I.M.S. *Minto* reported that a depth of 6 fathoms (11^m0) was obtained about 1½ miles westward of Kondul island, and that shoal water appeared to extend over a considerable area in this locality.

Anchorage may be obtained in a depth of 7 fathoms (12^m8), off the
10 eastern side of Kondul island, or off the western side, in depths of from 10 to 12 fathoms (18^m3 to 21^m9) according to the direction of the wind; as stated above, however, caution is necessary, especially if proceeding to the latter anchorage.

Kondul harbour.—Danger.—Anchorage.—Kondul harbour lies
15 between the southern side of Kondul island and the coast of Great Nicobar, and affords an airy and sheltered anchorage with no mangrove swamps in its vicinity.

A shoal with a depth of 2½ fathoms (4^m6) over it, but which has not been examined, lies about 8 cables south-south-eastward of the south-
20 eastern extremity of Kondul island.

Anchorage may be obtained, in depths of from 12 to 17 fathoms (21^m9 to 31^m1), sand and coral, taking care to avoid the above-mentioned 2½-fathom (4^m6) shoal.

Chart 840.

Western side of Great Nicobar island.—Coast.—Off-lying dangers.—Anchorages.—From the north-western point of Great
25 Nicobar island, the western coast trends southward for about 10 miles to Teesta point. About 4 miles south-westward of the north-western point of Great Nicobar, a bank with depths of from 7 to 8 fathoms
30 (12^m8 to 14^m6) over it, and over which the depths may possibly be less, extends about 3 miles offshore, and the depths are irregular for some distance northward and westward of the bank.

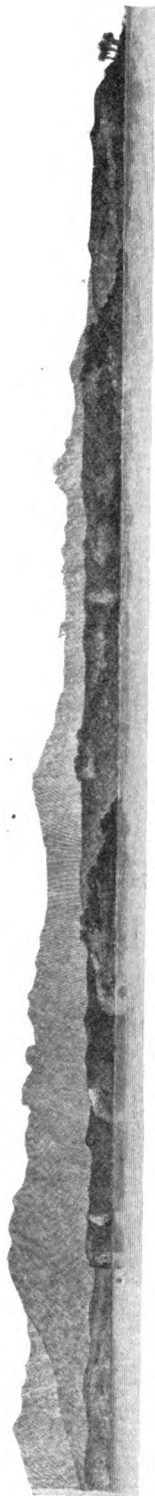
Casuarina bay is entered between a point about half a mile eastward of Teesta point, and a point about 1½ miles farther east-south-east-
35 ward; during the North-east monsoon, there is good anchorage for vessels with local knowledge, in a depth of 11 fathoms (20^m1), about one mile southward of the north-western entrance point of the bay.

From the south-eastern entrance point of Casuarina bay, the coast trends south-south-eastward for about 16½ miles to Pygmalion
40 (Parsons) point (*Lat. 6° 45' N., Long. 93° 50' E.*), the southern extremity of Great Nicobar island, *see* view facing this page. At the entrance to a bight between the villages of Kopenheat and Tæe-angha, situated about 3 and 5 miles, respectively, south-south-eastward of the south-eastern entrance point of Casuarina bay, there is anchorage for vessels
45 with local knowledge about one mile offshore in a depth of 15 fathoms (27^m4), but great care is necessary in approaching either this or the anchorage off Casuarina bay, as numerous shoals have been reported to exist from 3 to 5 miles offshore in this locality.

A small 4½-fathom (8^m2) patch, which in 1898 was reported to have
50 probably less depths over it, lies about 3½ miles westward of Kopenheat village, and a 3½-fathom (6^m4) patch, was reported in 1931 to lie about 2½ miles west-south-westward of the same village. Numerous shoals have been reported for a distance of about 5 miles southward of the above-mentioned 4½-fathom (8^m2) patch.

Charts 830, 70.

To face page 362.



*Pygmalion (Parsons) point,
bearing 090°.*

Southern end of Great Nicobar island.
(Original dated 1824.)

Chart 840.

The edge of the plateau on which Great Nicobar island stands, and which apparently extends for a considerable distance westward from the island, has not been determined.

Eastern side of Great Nicobar island.—Coast.—The eastern 5 coast of Great Nicobar island trends southward for about 29 miles between Murray and Pygmalion points and is hilly, wooded to the water's edge and much indented, but it is imperfectly known.

Chart 840, plan of Trinkat Champlong bay.

Trinkat Champlong bay.—Anchorage.—Trinkat Champlong 10 bay, lying between Murray point and Kerr point, about $1\frac{3}{4}$ miles south-eastward, affords good and safe anchorage for large vessels, and is completely sheltered from wind and swell during the South-west monsoon.

The north-western shore of the bay is rocky and steep, with occasional 15 coral heads extending from the coast for a distance of about one cable. The southern shore consists mainly of sandy beach; two conspicuous rocks are situated about $4\frac{1}{2}$ and 8 cables, respectively, westward of Kerr point. Northward of the western conspicuous rock, which is flat-sided, a coral reef, partly dry at low water, extends about $1\frac{1}{2}$ cables 20 offshore.

Elsewhere the bay is free from dangers, with depths of about 6 fathoms (11^m0) obtainable 2 cables offshore; inside the 3-fathom (5^m5) line, the coast should be approached with care.

The harbour is free from flies and mosquitoes.

In 1945, H.M.S. *Nelson* anchored with Murray point bearing 310° , 25 distant 7 cables, in a depth of about 28 fathoms (51^m2), coral and shell; small craft anchored inside the 10-fathom (18^m3) line.

Chart 840, plan of Láful anchorage.

Láful anchorage.—Directions.—Láful anchorage consists of an 30 open bight on the northern side of South point, which is situated about $3\frac{1}{4}$ miles southward of Kerr point; the bight is fringed by a ledge which is apparently steep-to, which extends about 2 cables offshore and over which there are depths of less than 5 fathoms (9^m1). The anchorage provides shelter from westward only, and a moderate swell 35 prevails.

The coast in the vicinity is moderately steep-to, with thick jungle coming down to within a few feet of high water mark. Some mangrove patches exist near the mouth of Crocodile creek at the head of the bight; fresh water is reported to be available above the tidal limit in 40 the creek, and crocodiles are found in the jungle in the neighbourhood.

Vessels should approach Láful anchorage with the middle of the southern half of the sandy beach, which is a good mark, bearing 270° , anchoring just before the coast southward of South point is shut in by that point. Caution is necessary as the depths decrease abruptly. 45

Chart 840.

South point to Tara point.—Coast.—From South point, the coast trends southward with no marked indentations for about $5\frac{1}{2}$ miles to Pigeon island, an islet lying close off the south-eastern entrance point of a bay which has not been surveyed, but is reported to be capable 50 of providing good, sheltered anchorage for a number of vessels, and in which depths of 17 fathoms (31^m1) are found close inshore; the bay is open north-eastward. Tenlâa bay, situated about 3 miles southward of Pigeon island (*Lat.* $7^\circ 05' N.$, *Long.* $93^\circ 54' E.$), is also well

Chart 840.

sheltered except from north-eastward, with depths of about 18 fathoms (32^m9) near its head, but the anchorage is narrow between dangers on either side.

- 5 From the south-eastern entrance point of Tenlâa bay, the coast trends south-eastward for about 2 miles, forming the north-eastern side of Koal-ta-pain, a promontory on the south-western side of which is Campbell bay, an inlet, exposed south-eastward and with a difficult entrance encumbered with rocks. Cerberus rock lies about half a mile
10 southward of the extremity of Koal-ta-pain.

- Between the southern entrance point of Campbell bay and Tara point, about 7½ miles south-south-westward, the coast forms a slight bight, the head of which is much indented. Boat rock, about one mile south-eastward of the northern entrance point of the bight, has three
15 smaller rocks close south-westward of it. Mataita-ánla, the southernmost indentation in the bight, is situated about one mile west-north-westward of Tara point; anchorage, sheltered from south-westward may be obtained in Mataita-ánla, but space is restricted on account of rocks and shoals.

20 *Chart 840, plan of South bay.*

- South bay.—Anchorage.**—South (Galathea) bay, entered between Hayward point, also known as Kwangtung point, situated about 3 miles south-westward of Tara point, and Pygmalion (Parsons) point, about 3¾ miles south-westward, affords fair anchorage during the
25 North-east monsoon, in depths of from 9 to 10 fathoms (16^m5 to 18^m3), but owing to its position, the heat is excessive.

- A rock with a depth of less than 6 feet (1^m8) over it, and over which the sea breaks, was reported in 1917 to lie about 6½ cables south-south-eastward of Hayward point, but its position is approximate.
30 Walker island, situated on the western side of the bay, about 1½ miles north-north-eastward of Pygmalion point, is flat and rocky, with no vegetation and several heaps of stone on it; it is easily identified from southward, but from eastward, is difficult to distinguish under the high land.

- 35 Galathea river, which flows into the head of the bay, is navigable by boats for a considerable distance, but a sand bar closes its mouth at low water.

- Landing can be effected in canoes at a gap in the reef about 1½ miles northward of Walker island, and at a similar gap on the eastern side
40 of the bay, about half a mile northward of Hayward point (*Lat. 6° 47' N., Long. 93° 52' E.*). In 1917, H.M.S. *Northbrook* found a convenient landing place at a position about 6½ cables south-south-westward of the charted position of the entrance to Galathea river; at this position there is a reef about half a cable offshore which forms
45 a natural breakwater.

Charts 840, 830, 70.

CHAPTER IX

PAGODA POINT TO TAVOY POINT, INCLUDING THE IRRAWADDY RIVER
AND THE GULF OF MARTABAN*Chart 823.*

IRRAWADDY RIVER.—General remarks.—The Irrawaddy river is formed by the junction of the N'maikha and Malikha, two streams which rise in the hills in the northern extremity of Burma; it reaches the sea by nine principal mouths, namely :—Bassein river and its eastern entrance Thetkethaung, Ywe, Pyamalaw, Irrawaddy, Bogale, Pyapon, China Bakir, and Rangoon rivers. 5

Some of these are of considerable width, but the Bassein and Rangoon mouths are the only ones at present used by sea-going vessels.

The Irrawaddy river is described in detail on pages 384 to 398. 10

Chart 834.

APPROACHES TO THE BASSEIN RIVER.—Off-lying dangers.—Pagoda point (*Lat.* 15° 57' N., *Long.* 94° 15' E.), the north-western entrance point of the Bassein river and the coast northward of it, are described on page 299. 15

Alguada reef with its light, situated about 15 miles southward of Pagoda point, is described on page 301.

Phaeton shoals are several rocky patches with depths over them of from 2½ to 3 fathoms (4^m1 to 5^m5), situated between 4 and 6½ miles north-north-eastward of Alguada Reef light and about a similar distance south-south-westward of Diamond island; they lie in the obscured sector of Alguada Reef light, between the bearings of 175° and 260°. 20

Diamond island. — **Light.** — **Dangers.** — **Light-buoys.** — Diamond island, situated close off the middle of the entrance to the Bassein river and about 5½ miles south-south-eastward of Pagoda point, is flat and wooded. See views A and B on chart 834. Turtles frequent the island at all seasons, but being a government monopoly, they must not be taken or disturbed. 25

A light is exhibited, at an elevation of 80 feet (24^m4), from a white iron framework structure, with a red horizontal band, 40 feet (12^m2) in height, situated on the north-eastern point of Diamond island.

Diamond island is fringed by reefs and shoals which extend as much as 4 cables offshore in places, and from its southern end, reefs, some of which dry 8 feet (2^m4), and foul ground, extend about 2½ miles south-south-westward. Patches with depths of 4½ fathoms (8^m2) over them, lie about 8 cables off the western side of the island. 35

Charts 3772, 823, 829, 830, 70.

Chart 834.

Baroni rock, about 6 cables north-north-eastward of Diamond Island light-structure, has a depth of $2\frac{3}{4}$ fathoms (5^m0) over it ; depths of from $3\frac{1}{2}$ to $3\frac{3}{4}$ fathoms (6^m4 to 6^m9) extend about a quarter of a mile 5 north-north-eastward from the rock.

A light-buoy, painted red and exhibiting a *white flashing* light of *one second* duration *every two-and-a-half seconds*, is moored about $3\frac{1}{2}$ cables north-north-eastward of Baroni rock. It is replaced by an unlighted buoy annually during the North-east monsoon.

10 A light-buoy, painted in black and white quarters, and exhibiting a *red flashing* light of *one second* duration *every five seconds*, is moored close east-north-eastward of the extremity of a $2\frac{1}{2}$ -fathom (4^m6) spit, which extends about 4 cables eastward from the light-structure.

Anchorage.—During the North-east monsoon, good anchorage may 15 be obtained about three-quarters of a mile eastward of Diamond island, in depths of from $4\frac{1}{2}$ to 5 fathoms (8^m2 to 9^m1), with the light-structure bearing about 300° , and Hainiggyi kyun summit (page 367) bearing 018° .

Landing may be effected in a small bay on the eastern side of the 20 island during the North-east monsoon, but landing is often impracticable during the South-west monsoon.

Pilotage.—Pilotage is compulsory for the Bassein river above Diamond island. There is no Pilot station at the river mouth and pilots have to travel down from the town of Bassein, about 78 miles 25 distant. To avoid delay, vessels should send their expected time of arrival at Diamond island to the Port Officer (telegraphic address PORTOFBASSEIN), so as to reach him at least 24 hours before the vessel is due to arrive.

If no pilot is available, which fact will be communicated to the vessel 30 by Radio through Rangoon coastal radio station, vessels should, during the North-east monsoon, proceed to the anchorage eastward of Diamond island but, during the South-west monsoon, they are advised to enter the river and anchor off Dalhousie point (*Lat. $16^\circ 03' N.$, Long. $94^\circ 24' E.$*), about 13 miles north-north-eastward of Diamond 35 island, to await a pilot.

Caution.—During the South-west monsoon a clearance of at least 4 feet (1^m2) is considered necessary when crossing the outer bar (page 368) on account of the swell.

Tidal streams.—The tidal streams set strongly across Phaeton 40 shoals, setting eastward with the rising tide and westward with the falling tide.

One mile northward of Diamond island the tidal streams at springs are rotatory ; at the commencement of the rising tide, it sets about 152° , turning through 090° , and ending at about 057° ; at the 45 commencement of the falling tide, it sets about 315° , turning through 270° , and ending at about 225° ; the rate of the streams is greatest between 2 and 4 hours after low and high water of the tide, when it is $1\frac{1}{2}$ knots.

Near the bar, the tidal stream sets about 090° during the rising 50 tide, and about 214° during the falling tide, at rates of from $1\frac{1}{2}$ to $3\frac{1}{2}$ knots during springs. During the rains, the outgoing stream may reach a rate of 6 knots at springs.

Directions.—In heavy weather the most suitable time for crossing the outer bar is between half-tide and two hours after high water at

Chart 834.

Diamond island. Vessels approaching Bassein river from westward, if proceeding to the anchorage eastward of Diamond island, should steer to pass about one mile northward of the island, rounding the extremity of the shoal which extends northward from Baroni rock (Lat. $15^{\circ} 52' N.$, Long. $94^{\circ} 17' E.$), and when Alguada lighthouse, bearing 207° , opens well eastward of Diamond island, they should steer for the anchorage. This approach is not recommended during the South-west monsoon. 5

If approaching from southward, the lighthouse on Alguada reef should not be approached nearer than 3 miles. Hainggyi kyun summit (see below), bearing 020° , well open eastward of Diamond island, leads about half a mile eastward of the shoals off Alguada reef, and of Phaeton shoals. After passing Phaeton shoals, vessels should steer for the anchorage eastward of Diamond island, taking care to guard against the effect of the tidal streams. 10 15

Storm and weather signals.—The extended system, see pages 30 to 34, is in use at Diamond island.

Climatic table.—See page 83.

Charts 829, 830, 70.

BASSEIN RIVER.—General remarks.—Bassein river leaves the main channel of the Irrawaddy a few miles above Henzada town (page 384), and flows in a south-westerly direction past Lemyethna and Ngathaingyaung towns, through flat delta country, to Bassein; it is the western of the channels by which the Irrawaddy reaches the sea, is connected with the other mouths by numerous large tidal creeks, and is navigable for a considerable distance. Its banks are, for the most part, low and covered with thick jungle. 20 25

The maximum draught for vessels using the port is 26 feet (7^m9). Deep draught vessels require high water to cross the outer bar, and also to cross Panmawadi flat, situated about 50 miles above the entrance. Inward bound vessels in ballast can usually reach Bassein in one tide, but outward bound vessels, with a draught of over 18 feet (5^m5) require two tides to get over the Panmawadi flats and the outer bar. 30 35

The river is only 2 cables wide at Bassein, and single-screw vessels exceeding 450 feet (137^m2) in length between perpendiculars, and twin-screw vessels, 475 feet (144^m8) between perpendiculars, are not recommended to use the port.

Chart 834.

Entrance.—Dangers.—The entrance to Bassein river lies between Pagoda point (page 299) and Purian point, about 11 miles south-eastward. 40

On the north-western side of the entrance, Hainggyi kyun (Hainggyi island) lies close offshore, Rocky point, its southern extremity, being situated about 5 miles east-north-eastward of Pagoda point; the summit of the island, a densely-wooded hill, 445 feet (135^m6) high, and sloping southward, forms a good mark about 8 cables south-westward of North-east point, the north-eastern extremity of the island which is situated about $2\frac{1}{2}$ miles north-north-eastward of Rocky point. The remaining parts of Hainggyi kyun are flat and covered with jungle about 35 feet (10^m7) high, but in 1890, a large round and prominent tree, 72 feet (21^m9) high, stood on South-east point, about 2 cables north-north-eastward of Rocky point. 50

Charts 3772, 823, 829, 830, 70.

Chart 834.

Sand cay (*Lat.* 15° 58' N., *Long.* 94° 19' E.), a rocky patch, 2 feet (0^m6) high, lies about 5 cables south-south-westward of Rocky point. A shallow flat on which the depths are less than 3 fathoms (5^m5), fills
5 the light between Sand cay and Pagoda point.

Hainggyi chaung, the channel between Hainggyi kyun and the north-western shore of the river, is only navigable by boats.

From Purian point, the south-eastern shore of the river trends northward for about 10½ miles to Ward point. Purian point, like all
10 the eastern shore, is low, but near its extremity is a grove of trees, 75 feet (22^m9) high. White sandstone cliffs, about 10 feet (3^m0) high, extend about 1½ miles north-eastward along the south-eastern side of the point, and similar cliffs, from 30 to 45 feet (9^m1 to 13^m7) high, extend for about 7 miles north-eastward and northward along the
15 opposite side of the point from a position about three-quarters of a mile from its extremity, being then lost in the jungle.

A reef which dries 6 feet (1^m8), lies about 8 cables south-south-westward of Purian point, and the passage between is foul with numerous sunken rocks.

20 Purian bank, on which the depths are less than 3 fathoms (5^m5), fronts the coast between Purian point and Ward point and extends as much as 5½ miles offshore, approaching to within about 1½ miles of Diamond island. Martin rocks, 4 feet (1^m2) high, and dark and jagged in appearance, lie on the inner part of Purian bank about 9 cables
25 north-north-westward of Purian point.

On the northern part of Purian bank, a spit with depths of less than one fathom (1^m8) on it, extends about 1½ miles northward, about 6 cables off, and parallel with the coast, from a position about 3½ miles south-south-westward of Ward point.

30 Orestes shoal, a patch with a depth of 3 fathoms (5^m5) over it, lies near the middle of the entrance between Diamond island and Pagoda point, about 2½ miles north-north-westward of Diamond island.

Bar.—Channel.—Buoyage.—The entrance to the river is obstructed by a bar which extends between the shallow flat close east-
35 ward of Pagoda point and the western extremity of Purian bank.

The least depth in the channel across the bar which passes south-eastward and eastward of Orestes shoal, is about 20 feet (6^m1) but, as stated previously, a clearance of at least 4 feet (1^m2) is considered necessary during the South-west monsoon. Within the bar, the
40 channel in some places is constantly changing and there are several rocks and shoals.

A can light-buoy, painted in black and white vertical stripes and exhibiting a *white flashing* light *every five seconds*, is moored about 2 miles southward of Rocky point and marks the south-eastern side of
45 the entrance channel.

Wolf rock, which dries, situated about 9 cables north-north-eastward of Rocky point and about 4 cables offshore, lies on a patch of foul ground which extends about 4 cables eastward of it; a black and white chequered buoy is moored close off the north-eastern extremity
50 of this foul ground.

Burgess rock, over which there is a depth of 3 fathoms (5^m5), lies nearly in mid-channel about one mile south-south-eastward of North-east point; a conical light-buoy, painted red and exhibiting a *white flashing* light *every four seconds*, is moored about 3 cables northward
55 of it.

Charts 3772, 823, 829, 830, 70.

Chart 834.

River above Hainggyi kyun.—Beacons.—Buoys.—Dalhousie or Fytche point (*Lat.* $16^{\circ} 03' N.$, *Long.* $94^{\circ} 24' E.$), situated on the north-western bank of the river, about $2\frac{1}{2}$ miles northward of Ward point, is a 40-foot (12^m2) bluff on which are a number of pagodas. 5
About 3 miles north-eastward of Dalhousie point is Stony point, on which stands a white pole beacon surmounted by a white cylinder.

Long sand, situated on the south-eastern side of the channel with its south-western end about 3 miles east-north-eastward of Ward point, consists of a long narrow shoal, parts of which dry and on which 10 there are two islands. In 1921, there were some trees on the southern island, and in 1890, there were trees about 25 feet (7^m6) high on the northern island.

Tazingyun or North and South Travers islands, consists of two islands lying close to the south-eastern bank of the river, the south- 15 western end of the southern island being about 6 miles east-north-eastward of Stony point beacon; there are two conspicuous trees close within the south-western point of this island. The northern island lies about 3 cables northward of the north-eastern extremity of the southern island, from which it is separated by a mud bank. 20

There are numerous leading beacons and buoys which mark the various channels and dangers above Tazingyun, but as changes in the channels are constantly occurring and a pilot is necessary, a description of all these marks will not therefore be given.

Khayegôn kyun or Salome island lies on the south-eastern side of 25 Ransom reach, about $8\frac{1}{2}$ miles north-eastward of the northern Tazingyun island, and about one mile farther north-eastward and on the same side of the reach, is Byangyi kyun or Mildred island.

Sesostris rocks extend about $4\frac{1}{2}$ cables from the western side of Ransom reach, westward of the southern end of Byangyi kyun. 30

Sinswe kyun or Enterprise island lies in mid-river about $3\frac{1}{2}$ miles northward of Byangyi kyun. Alexander rock, with a depth of $2\frac{1}{2}$ fathoms (4^m6) over it, lies about 5 cables south-south-westward of Sinswe kyun. Enterprise flat extends about $1\frac{1}{2}$ miles northward from Sinswe kyun with Pariah rock, on which there is a depth of less than 35 6 feet (1^m8), at the extremity of the flat. A black conical buoy surmounted by a cylinder, is moored about 2 cables north-eastward of the rock.

Pe-wet-seik kyun or Elephant island lies in mid-stream, about $3\frac{1}{2}$ miles northward of Sinswe kyun, and Amazon point is situated on 40 the eastern bank, about $1\frac{1}{2}$ miles northward of Pe-wet-seik kyun. An extensive shoal with depths of 3 fathoms (5^m5) or less, extends about $1\frac{1}{2}$ miles southward from Pe-wet-seik kyun, leaving a channel about 4 cables wide in which there is a least depth of $3\frac{1}{2}$ fathoms (6^m4), between its southern end and Pariah rock. Panmawadi flat, with 45 a least depth of one foot (0^m3), extends about 5 cables north-north-westward from Pe-wet-seik kyun. A shoal with depths of less than 6 feet (1^m8) over it, the position of which is approximate, lies about 8 cables south-westward of Amazon point.

Cockatoo point lies on the western bank of the river about $1\frac{1}{2}$ miles 50 north-westward of Amazon point; Ashby rocks, marked by a beacon, lie close northward of Cockatoo point.

About $2\frac{1}{2}$ miles north-north-westward of Amazon point and on the eastern bank of the river, is Elbow point (*Lat.* $16^{\circ} 31' N.$, *Long.* 94°

Chart 834.

41' E.), and at Thetke chaung, a creek on the south-eastern side of Junction reach, about 8 miles above Elbow point, are two prominent masts which carry a telegraph cable over the creek.

- 5 **Tide gauges.**—On Ashby rocks there is a tide gauge surmounted by a white cage, and marked in coloured plaques, red, black, and white, from the top; each plaque represents one foot (0^m3), and the lower edge of the top, white plaque marks 26 feet (7^m9).

Quarantine.—See quarantine regulations on page 40.

- 10 Vessels suspected of, or infected with, yellow fever must anchor off Dalhousie point, not less than half a mile from the low-water line; those with plague or cholera off a pagoda in the village of Taikaing, situated on the western bank of the river, about 2 miles below Bassein; those with other diseases at any anchorage below the wharves.

- 15 **Bassein town.**—**Port facilities.**—Bassein town, about 75 miles above the mouth of Bassein river, is visited principally by vessels between January and September. The town, which is situated in the middle of a fertile rice-growing district, stands on a slight eminence on the eastern bank of the river; the public offices and business
20 section are near the water-front, along which the jetties of numerous rice mills extend from both banks and are spread out over a large area. Shwemoktaw pagoda rises from the centre of a fort southward of which is the post office. On the western bank of the river is the suburb of Thinbawgyin.

- 25 Parts of the town suffered damage during the Japanese occupation from 1942 to 1945, and in 1947, little repair work had been carried out.

The climate is relaxing, owing to the situation of the town in the delta of the Irrawaddy, and to the muddy banks of the river and creeks which are covered during the greater part of the day.

- 30 Cholera prevails mostly from February to May. All drinking water should be boiled. Smallpox is never widely epidemic.

There is an average annual rainfall of 99 inches, most of which falls between May and September. In 1945, the population of Bassein was 50,518.

- 35 There are no wharves but each rice mill has one or more jetties with depths alongside of from 17 to 25 feet (5^m2 to 7^m6). Vessels are moored from 20 to 40 feet (6^m1 to 12^m2) away from the jetties and cargo is transported by hand as there are no cranes. Heavy articles are transferred by lighters.

- 40 Vessels are not normally supplied with coal, but in emergency a limited amount might be supplied from the small government stocks maintained.

Small amounts of petrol and lubricating oil are maintained.

- 45 Fresh provisions are scarce. Very small quantities of drinking water can be supplied. Water for cylindrical boilers can be taken from the river on the last of the ebb during the dry season or at any time during the rains. Water from the river is not suitable for water tube boilers.

- Minor repairs can be undertaken. There are three patent slipways;
50 for details of the largest of these, see Appendix I, page 489.

There is a civil hospital of moderate size.

There is regular sea communication with Rangoon (*Lat.* 16° 47' N., *Long.* 96° 10' E.).

There is a landing ground for aircraft about 4 miles north-eastward

Charts 3772, 823, 829, 830, 70.

Chart 834.

of the town, but in 1947, there were no regular civil air services in operation.

The principal exports are rice and timber, and the chief imports are piece-goods, coal, salt and coconuts.

Pilots.—There is a pilot station at Bassein.

Storm and weather signals.—The extended system, *see* pages 30 to 40, is in use at Bassein. The port receives information but displays no signals.

Chart 823.

PURIAN POINT TO BARAGUA POINT.—Coast.—Danger.

—**Caution.**—Between Purian point and Baragua point, the southern extremity of the Pyapon district, about 55 miles eastward, the coast is indented by many of the outlets of the Irrawaddy, including the Thetkethaung, Ywe, Pyamalaw, Irrawaddy and Bogale, five of its principal mouths. This stretch of coast is low and nothing conspicuous is visible from outside the shallow banks which front it.

A bank on which the depths are less than 3 fathoms (5^m5) fronts the whole coast between Purian and Baragua points, and extends as much as 17 miles offshore from a position about 10 miles westward of the latter point; there are numerous drying patches on the eastern part of the bank including Baragua flats, which extend about 8 miles south-westward of Baragua point. The coast is not visible from the southern extremity of this bank.

Vessels should not approach this part of the coast within depths of 10 fathoms (18^m3).

GULF OF MARTABAN.—Anchorage.—The Gulf of Martaban is entered between Baragua point and the coast extending northward abreast Kalegauk island, about 130 miles eastward; the Sittang river flows into the head of the gulf, about 70 miles northward of the entrance.

The Gulf is shallow throughout and anchorage may be obtained in any part where the depths will permit, but before anchoring, the direction of the tidal stream should be ascertained, and very little cable veered until the vessel stems it.

Baragua point to China Bakir river entrance.—Coast.

Beacons.—From Baragua point, the coast trends north-eastward for about 35 miles to the mouth of Pyapon river, the western outlet of China Bakir river, and thence east-north-eastward for about 23 miles to the main outlet of China Bakir river, which enters the sea through extensive mud flats.

U Pe beacon (*Lat.* 15° 44' N., *Long.* 95° 24' E.) is situated about 4½ miles east-north-eastward of Baragua point and about 1½ miles inland. Pymbong beacon is situated close within the coast about 6½ miles east-north-eastward of U Pe beacon.

Dangers.—Light-vessels.—Buoys.—Krishna shoal is a narrow detached ridge of hard sand with a least depth of 1½ fathoms (2^m3), which extends about 13 miles north-eastward from its south-western end, which lies about 11 miles south-eastward of U Pe beacon.

A light is exhibited, at an elevation of 45 feet (13^m7) from a light-vessel, painted red with "Krishna" in white letters on the sides, having a light-tower and one mast with a red ball at the masthead,

Charts 830, 70.

Chart 823.

moored about $6\frac{1}{2}$ miles south-eastward of the south-western end of Krishna shoal. A riding light is exhibited.

A black conical watch buoy is moored about 3 cables northward of the light-vessel.

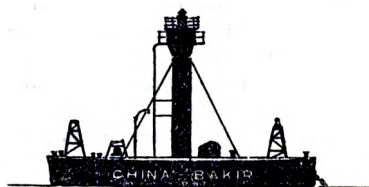
In 1922, a mud volcano, *see* page 43, was reported in a position about 30 miles eastward of Pymbong beacon, but a thorough examination of the position in 1929 failed to find any alteration in the depths.

In 1932, a mud volcano about 2 feet (0^m6) high, was sighted near the above-mentioned position.

In 1949, a 5-fathom (9^m1) patch was reported in a position about $48\frac{1}{2}$ miles eastward of U Pe beacon.

A light is exhibited, at an elevation of 45 feet (13^m7), from a light-vessel, painted red with "China Bakir" in white letters on the sides, having a light-tower amidships and a framework pedestal for auxiliary lights at each end, moored about 21 miles south-south-eastward of China Bakir river mouth. A fog signal is sounded and a riding light is exhibited, from the light-vessel.

A red conical watch buoy is moored about $2\frac{1}{2}$ cables northward of the light-vessel.



China-Bakir light-vessel.

Charts 833, 823.

China Bakir river.—The coast at the mouth of China Bakir or To river was well wooded in 1884, and from aloft the entrance to the river could be distinguished by a long and compact clump of dark trees on its eastern side, the western end of which, when seen from seaward abreast the entrance, terminated very abruptly. Eastward of this dark clump, the trees were much less compact, with occasional gaps. The western side of the entrance was also wooded but not so densely as the eastern side; there was a small clump of coconut palms near it which assisted in its identification. About $1\frac{1}{2}$ miles north-eastward of the eastern entrance point, is the village of Kanyingôn.

Both banks of the river are fringed with mangroves. About $2\frac{1}{2}$ miles within the entrance the river forks; Bassein creek, which is only available for small craft at high water, leads north-eastward and connects with Rangoon river about 10 miles below the city of Rangoon (Lat. $16^{\circ} 46' N.$, Long. $96^{\circ} 10' E.$), *see* pages 377 and 387; the other fork, which leads westward and north-westward, is partly blocked by an island and shoals.

Chart 833.

APPROACHES TO RANGOON RIVER.—**China Bakir river mouth to Elephant point.**—**Coast.**—**Dangers.**—From the eastern entrance point of China Bakir river, the coast trends north-eastward for about 15 miles to Elephant point, the western entrance point of the Rangoon river; Tazaung tower, tall and conspicuous, stands in the

Charts 823, 830, 70.

Chart 833.

village of Letkokkôn, situated on the coast about $3\frac{1}{2}$ miles east-north-eastward of the eastern entrance point of China Bakir river, and about 5 miles east-north-eastward of the tower is a conspicuous tree which, with the tower, make the only good landmarks on the above-mentioned stretch of coast. 5

An extensive drying bank of mud fronts the coast between the mouth of China Bakir river and Elephant point and extends from 2 to $4\frac{1}{2}$ miles offshore; China Bakir flats form the south-western part of the bank, the north-eastern part of which is named Spit sand and forms the north-western side of Western channel, the main entrance channel of Rangoon river. Several beacons and tide gauges, the positions of which may best be seen on the chart, stand on this bank; with the exception of three gauges, situated respectively, about $3\frac{1}{2}$ miles southward of Tazaung tower, about $5\frac{1}{4}$ miles south-south-westward of Elephant point, and about $2\frac{1}{2}$ miles south-south-eastward of the latter point, these tide gauges are now disused. The site of the old China Bakir lighthouse, which was destroyed, is on China Bakir flats, about 4 miles south-south-eastward of Tazaung tower. 10 15

Chart 823.

Current.—Tidal streams.—The current westward of the entrance to Irrawaddy river is irregular in the fine season, and varies with the direction of the wind, having no apparent connection with the rise or fall of the tide. 20

Off the mouth of Irrawaddy river and Baragua flats the tidal streams are rotary, shifting clockwise, and attaining, during the fine season, rates of from $1\frac{1}{2}$ to 2 knots at springs and about three-quarters of a knot at neaps. 25

Near the coast the tidal stream sets in and out of Irrawaddy river, attaining its greatest rate at high and low water. 30

Between a position about 22 miles south-south-westward of Baragua point and the entrance to Rangoon river, the streams set north-eastward and south-westward, attaining a rate of from 2 to 4 knots, at springs, during the North-east monsoon, which increases off the entrance to the river. The south-west-going stream is the stronger. 35

Occasionally, in October and November, a steady westerly set is experienced, quite overcoming the flood stream. During November, December, and January there is little or no tidal stream during the rising tide southward of Alguada reef, except at spring tides. See also tidal diagrams on chart 823. 40

Charts 833, 823.

Pilotage.—Pilot vessel.—Caution.—Pilotage is compulsory for merchant vessels of over 200 tons.

The pilot vessel is a steam vessel with two masts and a clipper-bow; she is painted white with "Pilot" in black letters on her sides. When she is off her station, for repairs, she is relieved temporarily by a steam tender. 45

The pilot vessel is usually at anchor about 20 miles southward of Elephant point (*Lat. $16^{\circ} 28' N.$, Long. $96^{\circ} 20' E.$*), in which position the tidal stream sets about 034° during the in-going tidal stream, and 214° during the out-going stream. 50

Vessels approaching the pilot vessel to obtain a pilot should pass astern and never ahead of her, and when in this position, make a lee for the boarding boat to the prevailing weather.

Charts 830, 70.

Charts 833, 823.

To enable vessels to locate the pilot vessel during thick weather, whether at anchor or under way, on the sound of a steamer's whistle or siren being heard making the signal prescribed by Article 15, sub-sections (a) or (b) of the Regulations for Preventing Collisions at Sea, she will sound, on the whistle or siren, *four blasts, two long and two short* (letter Z of the Morse code), and will repeat this signal at such intervals, and for so long a period, as may be necessary to enable the approaching vessel to locate the pilot vessel.

10 The pilot vessel is equipped with radio.

The pilot vessel exhibits the following signals:—

By day.—The regulation pilot flag (white and red horizontal).

When riding at anchor, a black ball or shape, not less than 2 feet (0^m6) in diameter, in the forward part of the vessel, at such a height 15 as to be clear of all superstructures other than the funnel, and not less than 20 feet (6^m1) above the hull.

By night—Lights and signals as prescribed by Article 8 of the Regulations for Preventing Collisions at Sea, and in addition, when at anchor, the lights prescribed under Article 11.

20 **Entrance. — Light. — Channels. — Bar. — Depths.** — The entrance to Rangoon river lies between Elephant point and Grove point, a low point about 3½ miles east-north-eastward.

Eastern Grove light is exhibited, at an elevation of 93 feet (28^m3), from a red pile structure with a black and white lantern, 105 feet (32^m0) in height, situated about 6 cables east-south-eastward of Grove point (*Lat. 16° 30' N., Long., 96° 23' E.*).

The approach to Rangoon river is obstructed by banks and shoals through which are three channels, of which only the westernmost is navigable by ocean-going vessels.

Eastern Grove flats, an extensive bank of mud and sand, extends about 6 miles south-eastward of Grove point and dries about 10 feet (3^m0). A bank with depths of less than 3 fathoms (5^m5) over it, extends a further 8 miles south-eastward from the southern edge of the flats, whence it trends in an east-north-easterly direction to the mouth of Sittang river (page 399). There are several drying sandbanks off these flats 40 and, as the southern edge of the coastal bank has not been thoroughly examined, vessels should give a wide berth to this locality.

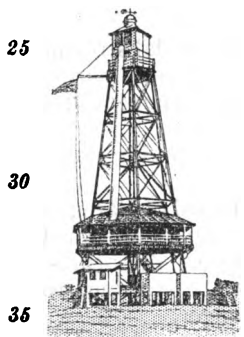
Chart 833.

Eastern sand, a shoal over which the depths are less than one fathom (1^m8), lies between 2 and 7 miles southward of Grove point and dries 45 as much as 8 feet (2^m4) in places.

The eastern channel lies between Eastern Grove flats and Eastern sand; in 1952, there was a least depth of 8 feet (2^m4) in the fairway of the channel which is not buoyed.

South-west tail, a flat on which the depths are less than 2 fathoms 50 (3^m7), with drying patches near its north-eastern end, lies about half a mile south-westward of Eastern sand. There is a narrow channel with a least depth of 10 feet (3^m0) between Eastern sand and South-west tail.

Western channel, which is the main entrance channel, lies approxi-



Eastern Grove light-structure

Charts 2135, 823, 830, 70.

Chart 833.

mately parallel with the outer edge of the drying mud flats fronting the coast between the mouth of China Bakir river and Elephant point. The northern part of the channel, known as Spit channel, is bounded on the eastern side by the shoal water extending westward from South-west tail. 5

The bar lies south-westward of South-west tail, and in 1952 there was a least depth of 15 feet (4^m6) in the fairway across the bar. The bottom is very soft silt into which the lead may sink 1½ feet (0^m5). In 1953 there was a least depth of 16 feet (4^m9) in the fairway of Western and Spit channels, and of 20 feet (6^m1) in the fairway of the river between Elephant point (*Lat. 16° 28' N., Long. 96° 20' E.*) and the entrance to Monkey Point channel (page 380), situated in the harbour of Rangoon, about 20 miles north-north-westward of Elephant point. 15

Caution.—The changes in the depths and in the positions of the banks and shoals in Rangoon river and its approaches are so frequent that the chart must not be taken as a sure guide. The uniform system of buoyage is not followed in Rangoon river and its approaches.

Light-floats. — Light-buoys. — Western Channel light-float, painted red and exhibiting a light from a framework structure amidships, is moored about 11½ miles south-south-westward of Elephant point. 20

Centre Western light-float, painted red and exhibiting a light at an elevation of 16 feet (4^m9), from a framework light-tower amidships, is moored on the bar about 7½ miles south-south-westward of Elephant point; this light-float, in transit with Spit light-float (*see below*) and Eastern Grove light-structure, bearing 029°, leads across the bar and through Spit channel. 25

Lower Eastern conical light-buoy, painted black and exhibiting a *white flashing light every second*, is moored on the eastern side of Spit channel, about 4½ miles southward of Elephant point. 30

Lower Spit can light-buoy, painted black and exhibiting a *white flashing light every seven seconds*, is moored on the western side of Spit channel, about 3 miles south-south-eastward of Elephant point. 35

Upper Eastern conical light-buoy, painted black and exhibiting a *white flashing light every three seconds*, is moored on the eastern side of Spit channel, about 3 miles south-south-eastward of Elephant point.

Centre spit can light-buoy, painted black and exhibiting a *red flashing light every six seconds*, is moored on the western side of Spit channel, about 2 miles south-eastward of Elephant point.

Spit light-and-bell float, from which an unwatched light is exhibited at an elevation of 26 feet (7^m9) from a framework structure amidships, is moored in the fairway of Spit channel, about 2½ miles south-eastward of Elephant point. The light-float is 40 feet (12^m2) in length and is painted black with three white horizontal bands on the light-structure; the float is equipped with a bell actuated by the motion of the waves. The light-float also exhibits a *white flashing riding light showing one flash every second*. 40



Spit light-and-bell float. 45

Upper Spit can light-buoy, painted black and exhibiting a *white*

Chart 833.

flashing light every second, is moored on the western side of Spit channel, about $1\frac{1}{2}$ miles east-south-eastward of Elephant point.

Chart 823.

- 5 **Directions.**—Vessels approaching Rangoon river from westward should pass about 5 miles southward of Alguada Reef lighthouse and should thence shape course for a position in lat. $15^{\circ} 22' N.$, long. $95^{\circ} 10' E.$, keeping in depths of not less than 10 fathoms (18^m3); from this position, course should be shaped to make good 090° for
10 a further 15 miles, whence course should be altered northward to make good 052° which passes south-eastward of Krishna and China Bakir light-vessels.

- During February and March, when thick fogs prevail, great caution is necessary when approaching the entrance to Rangoon river, as
15 there is not a sufficiently marked change in the depths in the channel to enable a vessel to determine her position by sounding. No attempt should be made to enter the river without first sighting China Bakir light-vessel.

- Vessels approaching Rangoon river from eastward should keep in
20 depths of from $5\frac{1}{2}$ to 6 fathoms (10^m1 to 11^m0) until the position has been ascertained.

- Caution.**—It should be borne in mind, when calculating the time and turn of the stream in any position between Alguada reef and the entrance to China Bakir river (*Lat. $16^{\circ} 19' N.$, Long. $96^{\circ} 06' E.$*), that
25 it is high water at the former about 6 hours earlier than at the latter.

- It must also be borne in mind that the land on both sides of the entrance to Rangoon river is very low, and mostly covered with jungle, and is not visible from seaward until about 7 miles from the coast. It is necessary to guard against being set eastward of the entrance to the
30 river, as the flood stream sets very strongly over the sands off the entrance to Sittang river (page 399).

Chart 833.

- Tidal streams.**—In Western channel the first of the in-going stream sets north-eastward in the direction of the channel, but after the banks
35 are covered, that is about $2\frac{1}{2}$ hours after low water, this stream sets strongly on to Spit sand over which it runs direct for Elephant point with a rate at springs of from 5 to 6 knots. The great body of this stream passes eastward into Sittang river. Considerable eddies may be experienced off Elephant point, especially on the first of the in-
40 going stream. In the eastern channel, the in-going stream is comparatively weak, setting north-westward, and makes from 20 to 30 minutes later than in Western channel.

- The out-going stream sets south-westward in Western channel and south-eastward in the eastern channel, with a rate of 6 knots at springs,
45 gradually altering its course south-westward as it sweeps round the south-eastern edge of Eastern sand. At the bend of Western channel, south-eastward of Elephant point, the out-going stream sets across the channel on to a part of Eastern sand.

- For tidal streams in Rangoon river above Elephant point, *see*
50 page 377.

Charts 830, 70.

RANGOON RIVER.—General remarks.—Rangoon river, which is a branch of the Irrawaddy, rises in the mountainous district of

Charts 2135, 823, 830, 70.

Chart 830, 70.

Prome, in Upper Burma in lat. $18^{\circ} 50' N.$, long. $95^{\circ} 25' E.$, being known as the Myitmaka, and flows south-south-eastward for a distance of 150 miles roughly parallel with Irrawaddy river. At a distance of about 50 miles from its mouth it takes a more easterly direction, and, under the name of Hlaing river, is joined by several large creeks near Rangoon; the chief of these are Panhlaing creek, Pegu river and Bassein creek. This portion of the river is navigable by shallow draught vessels. 5

Chart 833.

Below Panhlaing creek it is known as Rangoon river, and separates the city of Rangoon from the suburb of Dala, which is on the southern bank, close to the entrance to Twante canal; it flows from this in a south-easterly direction, entering the Gulf of Martaban between Elephant point and Grove point; it is a deep yellow colour due to the deposit brought down by it. 15

Ocean-going vessels can ascend the river to Rangoon. The country on both sides of the river between Elephant point (*Lat. $16^{\circ} 28' N.$, Long. $96^{\circ} 20' E.$*) and the city of Rangoon is low, flat and sparsely wooded but there are compact clumps of trees round the villages. The banks are clear of mangroves and the land is mainly under paddy with occasional patches of fallow land. In the freshet season (July to September), water hyacinths or beda weed are borne down the river in what is sometimes an almost solid mass, which may encumber jetties and moorings, and foul the propellers of small craft. 25

The buoys and beacons are moved as necessary to mark the channels.

Chart 833.

Tidal streams and tides.—Close above Elephant point on the south-western side of the river where the channel is confined by Middle bank, the in-going stream runs at a rate of from 5 to 6 knots at springs, decreasing as the north-western end of Middle bank, about 4 miles above Elephant point, is passed. 30

The out-going stream in Rangoon river generally takes the course of the channel and during spring tides there are strong eddies off the various points; off North D'Silva point, situated on the western bank about 13 miles above Elephant point, considerable eddies may be experienced, especially on the first of the in-going stream. 35

The tidal stream is strongest on the night of the second day after full or new moon; it then runs in the channels at the rate of about 5 knots, with only a few minutes slack water. After neaps the streams gradually increase in strength, and are rapid until the moon quarters, when they suddenly slacken; on the second and third day after the moon's quartering, there is slack water on the in-going stream for $1\frac{1}{2}$ hours, and on the out-going for one hour. 40

In the harbour, the ingoing stream commences about half an hour after low water and the outgoing stream about $1\frac{1}{4}$ hours after high water. 45

The in-going stream at springs makes suddenly and the tide rises 6 feet (1^m8) in the first hour; the out-going stream, however, still continues running in mid-channel, and it is not slack water until one hour after the water has commenced to rise. The in-going stream turns earlier inshore than in mid-channel. 50

During the rains, or from June to September, inclusive, the in-going stream is weaker, and the out-going stronger, than during the remainder of the year, and at times vessels do not swing to the in-going

Charts 2135, 823, 830, 70.

Chart 833.

stream off the city of Rangoon. The streams here may attain a rate of from 5 to 6 knots at springs.

Beacons. — **Dangers.** — **Buoyage.** — **Lights.** — An unlighted iron framework beacon, 51 feet (15^m5) in height, stands close south-westward of the extremity of Elephant point. The beacon is mounted on rails and is moved farther inshore periodically as necessitated by coast erosion.

A beacon, 70 feet (21^m3) in height, painted white and surmounted by a disc above a triangle, both painted black, stands on the eastern bank of the river, about 2½ miles north-westward of Eastern Grove light-structure.

Middle bank, which dries from one to 13 feet (0^m6 to 4^m0), is a continuation north-westward of Eastern sand; it lies in mid-stream with its north-western end situated about 2 miles northward of Deserter's creek leading light-beacons (*see* below).

The south-western side of Middle bank is marked by Lower Middle Bank can light-buoy, painted black and exhibiting a *white flashing light every four seconds*, moored about 8 cables north-westward of Elephant point; and Upper Middle Bank can light-buoy, painted black and exhibiting a *white flashing light every three seconds*, moored about 2½ miles north-westward of Elephant point.

Three leading lights, giving two lines of transit, are exhibited on the south-western bank of the river, about half a mile north-westward of the entrance to Deserter's creek, situated about 2½ miles west-north-westward of Elephant point (*Lat.* 16° 28' N., *Long.* 96° 20' E.). The centre light, which forms a common front light for both lines of transit, is exhibited at an elevation of 33 feet (10^m1). The rear lights have elevations of 53 feet (16^m2). The lights are exhibited from white iron framework towers with square daymarks. The transit lights for the lower reach in line, bearing 296½°, lead between the south-western bank of the river and the south-western edge of Middle bank, and those for the upper reach, in line bearing 154½°, lead between the south-western bank of the river on the south-west, and a shoal joining the north-western end of Middle bank and Hmawun Lumps, *see* below, on the north-east.

Hmawun Lumps is the name given to several shoals lying on the eastern side of the channel, about 5½ miles north-north-westward of the entrance to Deserter's creek. They are marked on their western side by a can light-buoy, painted black, marked H.L. and exhibiting a *white flashing light every five seconds*.

Hmawun beacon, a mast surmounted by a black ball, stands on the western bank of the river about 6 miles north-north-westward of the entrance to Deserter's creek; there are a number of other beacons on both banks of the river which are used for surveying purposes.

Danot beacon, about 8½ miles north-north-westward of the entrance to Deserter's creek, marks the northern entrance point of Bassein creek, which connects China Bakir river with Rangoon river, *see* pages 377 and 387. Hmawun chaung (Kyauktan creek) has its entrance on the eastern side of the river, about 3 miles south-eastward of Danot beacon.

South beacon, painted white and surmounted by a basket, stands on Dry Tree point which is situated on the eastern bank about 1½ miles eastward of Danot beacon.

Charts 2135, 823, 830, 70.

Chart 833.

D'Silva shoal, which dries 2 feet (0^m6), extends about 2 miles south-south-eastward from North D'Silva point, situated on the western bank of the river about 3 miles northward of Danot beacon. A can light-buoy, painted black, marked D.S., and exhibiting a *white flashing light every two seconds*, is moored about one cable eastward of the eastern side of the shoal where it bends southward. 5

Chokey Track leading lights are exhibited from white framework towers with square daymarks, situated on the eastern bank of the river about 2 miles northward of Dry Tree point; the front light has an elevation of 25 feet (7^m6) and the rear light of 38 feet (11^m6). These lights in line bearing 136½°, lead eastward of the main part of Chokey shoal, *see* below, and are known as Chokey track. 10

Three leading lights giving two lines of transit, are exhibited at Devil's Hole, situated on the eastern bank of the river, about 2½ miles northward of Dry Tree point. The centre light, which forms a common rear light for both lines of transit, is exhibited at an elevation of 67 feet (20^m4) from a white framework tower, 53 feet (16^m2) in height. The front light for the lower reach has an elevation of 27 feet (8^m2) and is exhibited from a white iron column, 15 feet (4^m6) in height; the front light for the upper reach has an elevation of 26 feet (7^m9) and is exhibited from a white iron column 25 feet (7^m6) in height. The transit lights for the lower reach in line bearing 014°, lead between the eastern bank of the river and D'Silva shoal, and those for the upper reach, in line bearing 110°, lead southward of Chokey shoal. 25

Sinha's beacon (*Lat. 16° 39' N., Long. 96° 15' E.*), a rail surmounted by a basket, stands on the western bank of the river about 2½ miles north-north-eastward of Danot beacon. The southern limit of the harbour is indicated on the chart by a pecked line drawn in a 071° direction from Sinha's beacon to the opposite bank. 30

Chokey shoal, with a least depth in 1953 of 17 feet (5^m2), lies nearly in mid-stream about one mile north-north-westward of North D'Silva point, situated on the western bank of the river about three-quarters of a mile north-westward of Sinha's beacon. 35

Lower Chokey can light-buoy, painted black and exhibiting a *white flashing light every five seconds*, is moored about 3½ cables northward of North D'Silva point. Upper Chokey can light-buoy, painted black and exhibiting a *white flashing light every two seconds*, is moored about 1½ miles north-north-westward of North D'Silva point. 35

Chokey track, which leads between Chokey shoal and the eastern bank of the river, is liable to sudden shoaling in August and may have depths of less than 2 fathoms (3^m7) in it between that month and March. 40

Leading lights are exhibited at elevations of 26 and 46 feet (7^m9 and 14^m0), from white iron framework towers, surmounted by white square daymarks, situated on the western bank of the river about 8 cables west-north-westward of North D'Silva point; these lights, in line bearing 177°, lead westward of Chokey shoal, and close eastward of the edge of Liffey sand, *see* below. 45

Chokey point, on which is Chokey beacon, is situated on the eastern bank of the river, about 1½ miles northward of North D'Silva point. 50

Liffey sand, which dries from one to 4 feet (0^m3 to 1^m2), lies in mid-stream and extends about 1½ miles northward with depths of less than 2 fathoms (3^m7), from a position about 3¾ miles north-north-westward

Chart 833.

of North D'Silva point ; a red conical buoy is moored close westward of the drying part of Liffey sand, about $3\frac{1}{4}$ miles north-north-westward of Chokey point, and a similar buoy is moored about 4 cables farther
5 westward.

A can light-buoy, painted black, marked L.S. and exhibiting a *white flashing light every five seconds*, is moored on the eastern side of Liffey sand, about $2\frac{1}{4}$ miles north-north-westward of Chokey point.

There is a measured mile in the reach between Chokey shoal and
10 Liffey sand, which is indicated by two pairs of beacons in transit ; the southern pair of beacons stand about 8 cables north-north-westward of Chokey point.

East Harbour beacon stands on the eastern bank of the river about 3 miles northward of Chokey point ; there are moorings for tankers
15 close off this beacon.

Chart 833, plan of Port of Rangoon.

Hastings sand, which dries from 2 to 3 feet (0^m6 to 0^m9), lies close northward of Liffey sand, being separated from it by Cross Sands channel. It is marked on its eastern side by Lower Hastings can
20 light-buoy, painted black and exhibiting a *white flashing light every second*, and on its northern side by a beacon on a stranded wreck, situated about $8\frac{1}{2}$ cables north-westward of the light-buoy ; foul ground exists about $2\frac{1}{4}$ cables northward of the light-buoy.

Cross Sands channel is marked in mid-channel by three black can
25 buoys, marked C.S.I, C.S.II, and C.S.III, from eastward ; in 1952, there were two drying patches at the eastern entrance to the channel.

West Harbour beacon (*Lat. $16^{\circ} 44' N.$, Long. $96^{\circ} 12' E.$*) stands on the western bank of the river about 5 miles north-north-westward of North D'Silva point ; King's beacon is situated about $4\frac{1}{2}$ cables farther
30 north-north-westward.

Pegu river flows into Rangoon river between Syriam point, about 2 miles north-north-westward of East Harbour beacon, and Pegu point, about 11 cables west-north-westward. Monkey point, which is also the south-western entrance point of Pazundaung creek, lies on the
35 northern bank of the river at the eastern end of the city of Rangoon and about half a mile south-westward of Pegu point.

A light for the use of aircraft is exhibited from each of two radio masts, 180 feet (54^m9) high, situated about $1\frac{1}{2}$ cables westward of the extremity of Monkey point.

40 Two pairs of leading beacons are situated about 3 cables and one cable, respectively, southward of Syriam point and form leading lines, known, respectively, as Hastings and Monkey Point tracks, which lead into the Port of Rangoon. The Monkey Point track, which is the northern, and leads into Monkey Point channel, usually carries a depth
45 of from 13 to 16 feet (4^m0 to 4^m9) and the Hastings track carries from 5 to 7 feet (1^m5 to 2^m1).

Lower Monkey Point can light-buoy, painted black and exhibiting a *white flashing light every four seconds*, is moored on the western side of the channel about 5 cables south-eastward of Monkey point.

50 Upper Monkey Point can light-buoy, painted black and exhibiting a *red flashing light every two seconds*, is moored on the southern side of the channel, about 2 cables south-south-eastward of Monkey point.

King's Bank training wall extends south-eastward across the north-western side of King's Bank sand which dries from 2 to 6 feet (0^m6 to

Chart 833, plan of Port of Rangoon.

1^m8), from a position on the western bank of the river about one mile north-westward of King's beacon. A light is exhibited, at an elevation of 17 feet (5^m2), from an iron tower, 19 feet (5^m8) in height, on the south-eastern extremity of the training wall. 5

Tidal signals.—A tidal semaphore, 120 feet (36^m6) high, stands about 3 cables westward of the extremity of Monkey point and indicates the tidal rise above L.W.S.T. as shown in the diagram on page 241. The signals are given as seen from southward and show the reverse way in Rangoon reach. 10

Chart 833.

Signals.—Vessels intending to pass through Monkey Point channel during daylight, should display the International Code flag signal BB when passing Dry Tree point, lowering the same for the information of outward-bound vessels, should any change take place regarding such 15 intention.

Anchorage. — Prohibited anchorages. — Buoys. — Obstruction.—The anchorage for vessels carrying explosives, indicated by pecked lines on the chart, is situated on the eastern side of the river close northward of Chokey point. 20

The lower quarantine anchorage is the same as that allocated to vessels carrying dangerous petroleum, indicated by pecked lines on the chart, between the eastern side of Liffey sand and the eastern bank of the river.

Chart 833, plan of Port of Rangoon. 25

The upper quarantine anchorage lies in the area between a line drawn 000° from King's beacon to the northern bank of the river, on the east, and a line drawn 180° from a position 14 cables westward of Monkey point to the southern bank of the river, on the west. 30

The anchorage for lighters carrying dangerous petroleum, indicated by pecked lines on the chart, is in the entrance to Pegu river (page 384), about one mile northward of Syriam point (*Lat. 16° 46' N., Long. 96° 13' E.*); a prohibited anchorage, also indicated by pecked lines on the chart, extends across the mouth of the river, close south- 35 westward of this lighter anchorage.

There is a prohibited anchorage, indicated by pecked lines on the chart, about 3 cables within the entrance to Pazundaung creek (page 384).

The anchorages for small craft and for country craft adjoin one 40 another and lie about half a mile south-westward of Monkey point; with the exception of the south-eastern corner of the small craft anchorage, the corners of these anchorages are marked by red conical buoys, the positions of which can best be seen on the chart; an obstruction, with a depth of 4 feet (1^m2) over it and marked on its northern 45 side by a green spherical buoy, lies about 2½ cables south-eastward of the north-western corner of the small craft anchorage.

There are numerous mooring buoys in the port, the positions of which can best be seen on the chart; vessels secure to the pendants with their own cables. 50

Port of Rangoon.—Beacon.—Obstructions.—From a position about 1½ miles westward of Monkey point, the port extends about 2 miles in a westerly direction with a width of about 4 cables. The northern side of this reach of the river is occupied by the water-front

Chart 833, plan of Port of Rangoon.

of the city of Rangoon. A beacon stands on Mower's point, situated on the southern bank of the river, about $3\frac{1}{4}$ miles westward of Monkey point.

- 5 Four obstructions, the exact positions of which may best be seen on the chart and over which there are depths of from 22 to 27 feet (6^m7 to 8^m2), lie between $7\frac{1}{2}$ cables east-south-eastward and $4\frac{1}{2}$ cables south-eastward, of the Port Commissioner's office tower, situated about 2 miles westward of Monkey point. Other obstructions, on
10 which there are depths of from 19 to 33 feet (5^m8 to 10^m1), lie about $1\frac{1}{2}$ cables south-south-westward, 4 cables westward, and 5 cables west-south-westward, of the same tower.

Chart 833.

- Shoal.—Light.—Beacons.**—Ahlone shoal, which dries from one
15 to 14 feet (0^m3 to 4^m3), together with a shoal which fringes it, front the northern bank of the river opposite Mower's beacon, and extend from a position about 4 cables north-north-westward of the beacon for about one mile west-north-westward along the river bank. The south-eastern extremity of the drying part of Ahlone shoal is marked by a
20 beacon standing on a wreck, and a small jetty extends from the shore along the eastern edge of the shoal; a prominent chimney stands on the eastern bank of the river, about $1\frac{3}{4}$ miles north-westward of Mower's point.

- The entrance to Twante canal (*see* pages 377 and 387) lies between
25 Mower's point and the extremity of Seikgyi training wall, about 5 cables westward; a submerged wall exists between the eastern side of the entrance channel of the canal and Mower's point. A light is exhibited, at an elevation of 13 feet (4^m0), from an iron tower, 17 feet (5^m2) high, situated on the extremity of Seikgyi training wall. A red
30 conical buoy is moored about 5 cables west-north-westward of Seikgyi training wall light-structure and marks the northern side of the channel, which here is about $1\frac{1}{4}$ cables wide between the training wall and the bank fringing Ahlone shoal.

- Twante canal and Kanaungto creek westward of it, are outside the
35 limits of the port; the port limit here is indicated by a pecked line on the chart between two beacons, situated one on either side of the entrance channel, about three-quarters of a mile west-south-westward of Mower's point.

- A prominent chimney (*Lat.* $16^{\circ} 47' N.$, *Long.* $96^{\circ} 07' E.$) stands on the
40 western bank of the river about $1\frac{1}{2}$ miles north-westward of the light-structure on the training wall and, sited at intervals along the training wall between the light-structure and this chimney, are three beacons, 15 feet (4^m6) in height and surmounted by disc topmarks; Seikgyi beacon, 50 feet (15^m2) in height, surmounted by a basket topmark,
45 dries about half a mile northward of the chimney.

Tide gauges.—In 1953 there were eight tide gauges on the river banks between Elephant point and Mower's point, situated as follows:—

- On the western bank: At Elephant point; at Sadaing Hmut, about
50 6 miles north-westward of Elephant point; and at a small jetty about half a mile south-south-westward of King's Bank training wall light. On the eastern bank: About 4 cables southward of Dry Tree point; at Chokey point; and at the Admiralty Fuel jetty, about $1\frac{1}{2}$ miles northward of Chokey point. On the northern bank: About 3 cables

Chart 833.

westward of Monkey point ; and at the eastern end of Brooking Street wharf (No. 2 berth).

Port limits.—The limits of the Port of Rangoon are as follows :—

On the south : A line drawn in an 090° and 270° direction through a position about 12 miles southward of Elephant point to meet, on the west, a line drawn in a 180° direction from the western outer entrance point of Bassein creek, and, on the east, a curved line drawn in a south-south-easterly direction from a position on the coast about $1\frac{1}{4}$ miles eastward of Grove point.

On the north-east : A line drawn across the Pegu river between two pillars, situated one on either bank, about $1\frac{1}{2}$ miles within the entrance.

On the north-west : A line drawn across the Rangoon river between two pillars, situated one on either bank, about $3\frac{1}{2}$ miles above Mower's point.

Directions.—As the channels in Rangoon river are constantly changing, no precise directions can be given. When approaching Syriam point, the rise of tide as shown by the tidal semaphore should be ascertained before proceeding through Monkey Point channel. Dredgers may be at work here.

Rangoon city.—Rangoon is the chief city and port in Burma ; it lies with its suburbs of Kemmendine and Pazundaung, on the northern bank of the river. Behind the wharves and warehouses the ground rises to a hill on the summit of which is the Shwedagon pagoda, about $1\frac{1}{2}$ miles northward of the river bank. On the southern bank is the suburb of Dala (Dalla), which possesses several slipways and timber mills but consists largely of native huts. Dala pagoda (*Lat.* $16^{\circ} 45' N.$, *Long.* $96^{\circ} 10' E.$), which is distinctive, lies about one mile west-north-westward of King's Bank training wall.

In 1950, the population was about 613,000.

Wharves.—Depths.—In 1952 there were depths of 24 feet (7^m3) at Brooking Street wharf and 34 feet (10^m4) at Sule Pagoda No. 8 berth Pontoon jetty. Depths at Sule Pagoda wharf are unstable and vary between 17 and 25 feet (5^m2 and 7^m6) ; there are four 500-foot (152^m4) berths at this wharf. Ahlone wharf in Kemmendine reach has a least depth alongside of 23 feet (7^m0).

There is a passenger jetty at Lewis street.

Port facilities.—Trade and shipping.—Moderate stocks of coal, fuel oil and diesel oil are maintained. Coaling is carried out in the stream or alongside from lighters using ship's appliances. Oil can be embarked alongside jetties near Syriam point or in the stream from barges ; the rate of fuelling is from 60 to 70 tons per hour at jetties and 40 tons per hour from barges.

Limited amounts of fresh provisions are available. Water is not laid on to the wharves but up to 400 tons can be supplied by water boat at 24 hours notice.

There are no cranes ; ships must use their own appliances.

Minor repairs can be undertaken ; there is a dry dock and a patent slipway at Pazundaung creek ; for details, *see* Appendix I, page 489.

There is a hospital to which seamen are admitted, a Sailors' Home and a Club (the Mayo Marine) for merchant seamen.

Since 1945, rice has been practically the only export ; the principal imports have been constructional material, machinery and consumer goods.

Chart 833.

In 1951, 496 vessels of 1,427,450 tons entered the port.

Deratisation.—Deratisation can be carried out and deratisation exemption certificates issued, *see* page 40.

- 5 **Communications.**—The wharves are connected with the general railway system.

There is regular sea communication with all parts of the world.

There is regular air communication with all parts of the world from Mingaladon airport, situated about 7 miles northward of Rangoon city.

- 10 **Storm and weather signals.**—The extended system, *see* pages 30 to 34, is in use at Rangoon. Signals are displayed at a flagstaff in front of the Port Commissioners offices.

Climatic table.—*See* page 84.

Charts 830, 70.

- 15 **Pegu river.—Pazundaung creek.**—Pegu river and the river known as Pazundaung creek both rise on the slopes of Pegu Yoma and flow into Rangoon river close eastward of Rangoon city. Pegu river is navigable by light draught vessels as far as Pegu, about 40 miles north-north-eastward of Rangoon, during the rainy season; Pazundaung creek is navigable by boats for a distance of about 40 miles. About 35 miles above Rangoon (*Lat.* 16° 46' N., *Long.* 96° 10' E.) it is 50 feet (15^m2) wide, flows between high steep banks, and has a depth of 3 feet (0^m9) during the dry season, with a tidal rise of 1½ feet (0^m5); towards its mouth the river banks are steep and muddy.
- 25 A bore, about 3 feet (0^m9) high, sweeps up Pegu river, especially in February, March and April, and its effects are felt at Pegu (*Lat.* 17° 18' N., *Long.* 96° 29' E.) in the sudden rising of the early flood.

- IRRAWADDY RIVER.**—The Irrawaddy river, at all seasons of the year, is navigable by power vessels, through the greater part of its course. The Irrawaddy Flotilla Company has a large number of steamers which keep up regular communication with the places on the banks of the river. They also maintain a large fleet of launches which ply regularly between the more important villages and towns scattered throughout the lower reaches of the Irrawaddy, through the tidal creeks and channels, which intersect the delta regions. In addition to the above, this Company have a small fleet of stern-wheel vessels of very shallow draught running a regular service between Pakokku, 494 miles * up river from Rangoon, and places on the banks of the Chindwin river as far up as Homalin, 397 miles above Pakokku.
- 40 At most of the important towns and villages on the banks of the river, this Company have what are known as station flats, across which cargo of considerable bulk and weight, can be loaded or unloaded with little difficulty. There is a small floating dock at Mandalay with a deadweight capacity of 350 tons, but in 1953 it was reported that,
- 45 owing to its poor condition, the safe working load was limited to 200 tons.

- The river is the main source of the water supply to the towns and villages on its banks, but it is tidal as far as Danubyu, about 106 miles from Rangoon. The river cuts through a line of railway and a steam ferry plies between Tharrawaw and Henzada. At Sagaing, a few miles below Mandalay, the river is spanned by a combined road and

* The distances given in the description of the Irrawaddy and Chindwin rivers are statute miles.

Charts 830, 70.

railway bridge, the four middle spans of which are navigable all the year round by the largest of river steamers.

The Irrawaddy delta is constantly encroaching on the sea, owing to the immense quantity of silt brought down by the river, and is cut up into many low islands by numerous tidal creeks and channels. Scattered throughout the southern parts of these are temporary villages, which are occupied during the dry season. 5

The principal affluents of the Irrawaddy are the Mogaung, Taping, Shweli, Madaya, Mu, Chindwin, Yaw, Mon, and Man rivers. The Chindwin is by far the largest of these affluents, although the depths are not so great as in the Irrawaddy. It drains a large area of country and, on joining the Irrawaddy in about lat. $21^{\circ} 45' N.$ it may, if coming down in full flood, almost double the volume of that river.

Except for the Chindwin river, none of the affluents of the Irrawaddy is navigable for any distance from their mouths. In the dry season most of them are mere trickles of water, only navigable by the smallest of boats. In the rains they fill up, bringing down large numbers of logs, and drift of all kinds. Many of the trees brought down by these streams are large and capable of causing considerable damage to river steamers, and must be avoided. 15 20

In addition to the rocks, wrecks, and other navigational dangers, snags are frequently encountered. These, if in, or near, a navigable channel, and likely to impede navigation, are removed.

There are three defiles through which the Irrawaddy flows:— The northern, above Bhamo town, about 900 miles from the coast by river, is navigable by boats and very small steam vessels only in the dry season. 25

The second defile, about 20 miles southward of Bhamo, is 8 miles long and about three-quarters of a cable wide at its narrowest part, the greatest depth being 23 fathoms (42^m1). On either side of the defile are hills which rise almost vertically to an elevation of about 900 feet (274^m3). 30

The third defile, about 35 miles above Mandalay, through which the river flows between two ranges of mountains trending northward and southward, is 29 miles long, and a quarter of a mile wide at its narrowest part, with an average depth of 4 fathoms (7^m3). 35

Pilots.—Great experience is necessary for navigating the river. No rules can be laid down for its navigation, as changes frequently take place; the frequent fluctuations of the river can only be followed by years of experience in river navigation, and by the constant observation of local pilots, who are qualified for sections up to about 65 miles in length, and are in the employ of the Irrawaddy Flotilla Company; they can be considered trustworthy. Masters of the Irrawaddy Flotilla Company pilot their vessels as far as Yandoon, 88 miles from Rangoon; thence to Bhamo on the upper reaches of the Irrawaddy, and to Homalin on the upper reaches of the Chindwin, the Company's local pilots are employed. Experienced native pilots are stationed at Mandalay, Kyaukmyaung, Tagaung, Katha, Shwëgu and Bhamo (*Lat. $24^{\circ} 12' N.$, Long. $96^{\circ} 52' E.$*). 40 50

Buoyage.—The channels are buoyed as far as Myitkyina on the Irrawaddy about 125 miles above Bhamo, and to Homalin on the Chindwin. The buoys, which consist of bamboos, are painted red, on the port side of the channel, proceeding up stream, and white on the

Chart 748b.

Charts 830, 70.

starboard side. In addition to bamboo buoys, beacons are extensively used in the delta regions below Myanaung (page 388). Double beacons are erected to indicate the crossings, and single beacons are used as
 5 intermediate leading marks, or to delineate the low parts of the river banks which are inundated during the rainy season. These beacons have been found to be particularly useful to vessels navigating the delta by searchlight at night.

Double beacons are two single beacons erected close together but
 10 not as transits.

General remarks.—Irrawaddy river is encumbered with islands and sandbanks, many of which are submerged during the rains, and the left bank then suffers from inundations. Between Mandalay and the junction with the China Bakir river, the general width of the
 15 river varies from a quarter of a mile to $1\frac{1}{2}$ miles. The main banks which are generally distinguishable by high trees, pagodas, etc., are as a rule stationary, but the shapes of the flat alluvial islands and banks, facing them, are constantly being altered by the streams. The channel rarely keeps to the same bank for more than 3 miles, a small
 20 projection from the bank being sufficient to deflect the water towards the opposite side. Obstructions, such as snags, beds of shingle, and rock outcrops, often exist under water, and cause the crossings to assume an S shape; this is the most difficult form of crossing.

Generally the stream runs fastest in the deepest part of the channel.
 25 Pilots coming down the river, watch the play of light on the water, to detect the curves that the rapid moving water is taking through the dead water of the shallows.

When possible, vessels should keep to the up-stream sides of the crossings, so that in case of grounding she may be swung off into deeper
 30 water.

Depths.—Rise of river.—For administrative purposes the dry season is considered to be from 1st November to 14th June and the rainy season from 15th June to 31st October.

During the dry season the river is navigable to Mandalay by vessels
 35 with a draught of 6 feet (1^m8), but during February and March, there are occasions when draughts have to be restricted to 4 feet 3 inches (1^m3) on account of a few exceedingly shoal crossings. In the dry season the upper reaches of the river from Mandalay to Bhamo, are navigable by vessels with a draught of 4 feet (1^m2), but here also,
 40 draughts have often to be restricted to 3 feet 9 inches (1^m1) for short periods, because of very shoal crossings. During the rainy season, from about the first week in June to the end of October, the river is navigable to Bhamo by steamers with a draught of 10 feet (3^m0) but 6 feet (1^m8) is the recognised maximum draught of river vessels.

45 The above-stated draughts are only acceptable if the river is properly buoyed and leading marks are in position.

The river has been ascended from Rangoon to Thayetmyo, 303 miles from the coast, during the month of July, by a vessel with a draught of 10 feet 2 inches (3^m1). The track taken was through Panhlaing
 50 creek, which joins the main river at Yandoon about 60 miles above Rangoon; the same vessel descended the river and reached Rangoon through the China Bakir river and Bassein creek. The navigation of the main stream in July was easy, and there was sufficient depth for a vessel with a draught of 15 feet (4^m6).

Chart 748b.

Charts 830, 70.

In March, the river commences to rise, and it usually attains its maximum height in August, at which time, at Prome, it is about 35 feet (10^m7) above its dry season level. In 1939, it was low water at Prome on the 29th March, the gauge being at 59.7 feet (18^m2) above sea level. On the 11th of August the river at Prome reached its highest level for that year, with the gauge standing at 97 feet (29^m6) above sea level, this being about 3 feet (0^m9) above the mean high level. In 1877, the river is said to have risen 9 feet (2^m7) above the mean high level, the highest rise recorded. The rise varies, being sometimes greater at Prome than at Thayetmyo, 40 miles above, but generally it is less below and more above Prome.

The most efficient type of propulsion is considered to be the side paddle on the Irrawaddy and the stern wheel on the Chindwin.

Current.—The average rate of the stream above tidal influence is 3 knots, but at some points it attains a rate of from 5 to 6 knots. The stream usually runs with great strength at Akauk taung, locally known as Gaudama hill in lat. 18° 25' N., long. 95° 11' E., a rate of 7½ knots having been experienced in August.

Charts 2135, 830.

Routes.—Throughout the year large vessels and launches depart from, and return to, Rangoon, through the Twante canal, which joins the China Bakir river at Twantewa, 22 miles from Rangoon. The usual time for entering the canal from the Rangoon end, is shortly after the first of the ebb, and from the China Bakir river end, from 2½ to 3 hours before high water at Rangoon.

An alternative route to and from Rangoon to the main stream, is through Bassein creek, *see* pages 377 and 387. This creek has deteriorated in recent years, and during the period of low neap tides, is impassable for vessels towing flats with a draught of more than 5 feet (1^m5). During the rainy season, it is navigable by vessels towing flats with a draught up to 6 feet (1^m8). Launches up to 150 feet (45^m7) in length and with a draught of 5 feet 6 inches (1^m7), can proceed through this creek in either direction, all the year round.

At low water the Bassein creek dries in many places, but by entering at the proper time, from the Rangoon end, 3 hours before high water at Rangoon and from the China Bakir end, from 4 to 4½ hours before high water at Rangoon, a vessel can get through without stopping. The tidal stream separates about half way through, so that if a vessel enters with the flood, at either end, and proceeds as the water rises over the shoal parts, maintaining a speed of about 6 knots, the other end can be reached with the first of the ebb. The track followed from the China Bakir end of Bassein creek to the main stream, is up the China Bakir river, keeping to the left bank for about 8 miles. The channel then crosses to the right bank and passing the wreck of a river steamer close to port, thence to Dedaye, 2 miles above. From Dedaye to Twante, 24 miles on the left bank the channel follows the natural bends of the river. At low water, there are depths of 8 feet (2^m4) on the crossing below Dedaye.

The route to the Irrawaddy through the Panhlaing creek has deteriorated in recent years, and during some dry seasons, is not navigable by vessels with a draught of over 5 feet (1^m5). During the rainy season, vessels up to 150 feet (45^m7) in length and with a draught of 10 feet (3^m0), can get through in safety. This route, however, is narrow

Chart 70.

Charts 2135, 830.

and intricate in many places, and is so tortuous, that only small power vessels with twin screws can turn.

Another route from seaward to the main stream, is up the Bassein river to Bassein, which is navigable by sea-going vessels, thence to Ngathainggaung, 77 miles above Bassein. From Ngathainggaung the route to the main Irrawaddy stream continues *via* the Ngawun river, which enters the Irrawaddy at Sitkyun village, 21 miles from Henzada and about 60 miles above Ngathainggaung. This route is open only during the rainy season, when vessels with a draught up to about 12 feet (3^m7) could get through to the Irrawaddy. The Ngawun river is crossed by a railway bridge at Myogwin, a span of which has to be raised to allow the passage of vessels.

Chart 2135.

15 *Rangoon to Prome.*—The following is the route from Rangoon to Prome (Lat. 18° 49' N., Long. 94° 55' E.) all the year round.

From Rangoon to the eastern end of the Twante canal thence through to Twantewa, 22 miles. From the western end of the Twante canal up the China Bakir river to Maubin, 44 miles on the right bank. 20 Maubin is a town with a population, in 1931, of 8,897 and is the district headquarters. This is a good stretch of river with depths of not less than 2 fathoms (3^m7) during the dry season. There is one hairpin bend, known as Butterfly bend, which requires careful navigation when descending the river during the flood season.

25 From Maubin to the Hole-in-the-wall, where the China Bakir river joins the Irrawaddy river, is another good reach of 15 miles, with depths of not less than 3 fathoms (5^m5) in the dry season. From the Hole-in-the-wall to Yandoon, 27 miles on the left bank. Yandoon is a town, situated at the junction of the Panhlaing creek and the Irrawaddy, with a population, in 1931, of 9,925. This stretch of river has no navigational difficulties, but there are depths of 2 fathoms (3^m7) in mid-channel. It is the first pilot station.

From Yandoon to Danubyu, 18 miles on the right bank. Danubyu is a town with a population, in 1931, of 6,334. This is a very good 35 stretch of river with depths of not less than 3 fathoms (5^m5).

From Danubyu to Zalun, 27 miles on the right bank. This stretch of river is usually good during the dry season, but the Ywebathaung channel, about 5 miles below Zalun, sometimes shoals to as little as 7 feet 6 inches (2^m3). From Zalun to Henzada, 17 miles on the right 40 bank. Henzada is a town with a population, in 1931, of 28,542 and is the district headquarters. It is connected with the general railway system and is the second pilot station. This is a very good stretch of river. From Henzada to Kanaung, 51 miles on the right bank. Kanaung is a large village. It is in this stretch of river that the 45 difficulties of river navigation can be said to begin. During most dry seasons there are usually several tortuous and shoal channels and crossings with depths of 5 feet 6 inches (1^m7) in them.

From Kanaung to Myanaung, 7 miles on the right bank. Myanaung is a town with a population, in 1931, of 9,072. This short reach is 50 usually difficult during the dry season. The channels are narrow and tortuous and often shoal to 5 feet 3 inches (1^m6). The first of the rock outcrops is encountered in this reach. A large patch of rock below the town and from about 700 to 800 feet (213^m4 to 243^m8) from the right bank, is exposed when the river is low. This is the third 55 pilot station.

Chart 70.

Chart 2135.

From Myanaung to Kyangin, 8 miles on the right bank. Kyangin is a village with a population, in 1931, of 6,780. This short stretch of river usually remains good during the dry season and depths of not less than 6 feet (1^m8) can be expected. Immediately above Myanaung, some outcrops of rock with depths of from 2 to 3 feet (0^m6 to 0^m9) over them lie close in on the right bank. During some dry seasons the navigable channel has been known to run through between these outcrops. 5

From Kyangin to Prome 48 miles on the left bank. Prome is a town with a population, in 1931, of 28,295 and the headquarters of the district. Prome is the fourth pilot station. It is connected to the general railway system. For several months during the dry season this stretch of river can be very difficult for navigation, some channels shoaling to as little as 5 feet (1^m5). At Akauk taung, about 19 miles above Kyangin, the channel often narrows to about 220 feet (67^m1) wide abreast a cliff which rises 400 feet (121^m9) sheer out of the water. When this occurs, large vessels descending the river, have to turn round above, then dredge down on their anchors, letting the current carry the vessel through the defile using an anchor or anchors dropped underfoot as a drogue, and the engines and rudder as necessary to keep the vessel in the fairway of the channel, an operation requiring considerable skill and experience in the handling of river steamers. The face of this cliff is covered with images of Buddha carved out of the rock, and is the first high land met with when ascending the river. At Seiktha, 6 miles above Kyangin, a large outcrop lying well out towards the centre of the river, is exposed during the dry season. About 9 miles below Prome and near Shwedaung, there is a large area of shingle, which often causes the channels in that neighbourhood to become very tortuous and shoal. Almost opposite Prome (*Lat. 18° 49' N., Long. 94° 55' E.*), the wreck of a river steamer lies well over to the right bank and is just visible at low water. 25 30

The time taken in the above passage by river steamers with two flats in tow, and including delays at stopping places, is about 40 hours. The down passage from Prome to Rangoon by the same route can be made in 2½ days, including overnight stops. During the wet season and following the same route, the average time taken from Rangoon to Prome is 3 days, and from Prome to Rangoon 2½ days. 35

Note :—In recent years express and cargo vessels have been running day and night through to Prome. 40

The total distance from Rangoon to Prome is 263 miles.

Chart 2136.

Prome to Yenangyaung.—Dry and rainy seasons.

From Prome to Thayetmyo, 40 miles on the right bank. Thayetmyo (*Lat. 19° 37' N., Long. 94° 54' E.*) is a town with a population, in 1931, of 9,279 and is the district headquarters. 45

Between Prome and Kama, 17 miles up river, the river runs through a modified defile, in places less than a quarter of a mile wide, and with the hills on both sides rising almost sheer from the water. In the rains the current runs strong in this section, averaging between 6 and 7 knots. The banks are for the most part, rocky, and the channels often become narrow and close to them, requiring careful navigation when descending the river. Above Kama, the river widens out to well over a mile in places. This stretch of river seldom gives 50

Chart 70.

Chart 2135.

trouble during the dry season, and a depth of 5 feet 6 inches (1^m7) in the channels and crossings can be expected in a normal season. At Thedaw, about a mile below Thayetmyo, there are some large cement works, and at Allanmyo, across the river from Thayetmyo, there is a large cotton ginning mill, and an oil press.

Thayetmyo to Migyaungye, 47 miles on the left bank. Migyaungye is a village of little importance. This is the fifth pilot station. The river runs almost due north in this reach, skirting the eastern face of a range of hills 1,200 feet (365^m8) high. At three points it is divided into two channels by fairly large islands. (1) At Kyaukchet kyun, an island, 25 miles above Thayetmyo. The navigable channel lies westward of this island. The channel on the eastern side is foul with rock, and there is a wreck of a river steamer lying off the village of Kyaukchet, so it is never used by river craft. The western channel is sometimes difficult, and in April, 1929, it shoaled to 4 feet (1^m2) for over a week. (2) Abreast Lungyi village, about 7 miles above Kyaukchet kyun. This island is about 2 miles in length and is wooded, with a sandbank projecting from its northern and north-western sides. The channel, which is narrow but deep, lies along the western bank. Strong eddies, caused by outcrops of rock off this bank, are encountered here. The eastern channel leading up past the town of Sinbaungwe, is only navigable in the wet season. (3) Abreast Taunggwin village, which is about 2 miles below Migyaungye, the channel is about a mile and a half in length and has some pagodas on it. The channel leads westward of the island, and at the lower end there is a flat outcrop of rock lying about 100 feet (30^m5) out from the right bank. The channel is always narrow here and care is necessary when descending the river. In a normal dry season the average depth in the channels between Thayetmyo and Migyaungye, is 5 feet 6 inches (1^m7) during the dry season.

From Migyaungye to Minhla, 9 miles on the right bank. This short reach is always good during the dry season, there is no middle ground, and the course is an easy one, the river flowing between hills from 100 to 300 feet (30^m5 to 91^m4) high. The old Burmese fort of Kola-kone occupies the heights opposite the town. The ghât, or landing place, is close to a small ruined fort in the centre of the town.

Minhla to Yenangyaung, 42 miles on the left bank. Yenangyaung is a town with a population, in 1931, of 11,098 and is the sixth pilot station. This is a very difficult reach every dry season; there are numerous sandbanks throughout the whole season and the channels are continually shifting. Yin chaung joins the Irrawaddy about 7 miles above Minhla. In November, 1935, this river was in spate, bringing down large quantities of silt, and forming shoals in the most unexpected places. The current immediately below increased to about 8½ knots, and river steamers had difficulty in making head-way.

There are two large towns in this reach, Minbu, on the right bank and Magwe on the left bank with populations, in 1931, of 6,005 and 8,209, respectively. Both are the headquarters of the districts of the same names. Magwe is 19 miles above Minhla, and consists of a group of villages collected round the civil station; the chief feature seen from the river, is Myathalun pagoda, standing on a slight eminence. Vessels can approach close to the bazaar. Minbu is on the right bank opposite Magwe. Large sandbanks formed by the silt brought down

Chart 70.

Chart 2136.

by Man chaung, which enters the Irrawaddy through the right bank about 2 miles above the town, prevent river steamers approaching the bank within 7 miles of it. The landing place during the dry season is at Palanyon, 7 miles down stream. Between Minhla and Magwe, 5 intricate channels, with a depth of only 5 feet (1^m5) in them, can be expected every dry season. Above Magwe, the river opens out considerably, and is over 2 miles wide in places. Many central low-lying islets and sandbanks make the channels through this section tortuous. These low islands cover during the rains, the grass only 10 showing above water. In the dry season they are covered with elephant grass and several of them are cultivated. The hills lie well back in this reach, except at Magwe and at Thapanzeik, a village about 5 miles farther northward, and on the southern side of an abrupt rocky point with cliffs from 80 to 120 feet (24^m4 to 36^m6) high, each 15 with a pagoda on its summit. The channel usually passes close to this point, is always very narrow, and during January and February, 1940, vessels descending the river had to dredge down on their anchors, see page 389, when passing the point. From Thapanzeik to Yenangyaung the channels are usually very good and a depth of not less 20 than 6 feet (1^m8) in them is to be expected. Kadaung chaung joins the Irrawaddy river through the left bank some miles below Yenangyaung; Mon chaung enters opposite Yenangyaung, and Pin chaung enters through the left bank about one mile above Yenangyaung (Lat. 20° 35' N., Long. 94° 42' E.). 25

The distance from Prome to Yenangyaung is 138 miles, and the total distance from Rangoon, 401 miles.

The time taken by express vessels from Prome to Yenangyaung is about 1½ days. The cargo steamers take about 2½ days to do the same run, including overnight stops. *Above Yenangyaung.*—From 30 Yenangyaung to Nyaungu, 77 miles on the left bank. Nyaungu had, in 1931, a population of 8,118, and is the seventh pilot station.

The most important places on this reach are:—Salin, Sinbyugyun, Lanywa, and Yenangyat, on the right bank and Sale, Chauk, Singu, and Pagan on the left bank. Salin and Sinbyugyun are situated on 35 a wide plain irrigated by canals. There are numerous smaller villages scattered throughout this plain. Sale is 38 miles up river from Yenangyaung, and 7 miles farther up is Chauk. At Singu there are some oil wells close to the river bank, which has a guide or retaining wall. 40

Yaw chaung enters the Irrawaddy river through the right bank opposite the town of Chauk. Across the river from Singu, is Lanywa, another petroleum field with a guide or retaining wall. About 9 miles above Lanywa and on the same side, is Yenangyat, another small oil field. The wells are on the eastern slopes of the hills, which are 45 nearly 2,000 feet (609^m6) high. In the dry season, these hills are almost devoid of any kind of growth and have a desolate appearance, in striking contrast to the densely wooded country below. About 7 miles above Yenangyat and on the left bank is Pagan, in which there are many pagodas. Nyaungu, 10 miles above Pagan, is also 50 on the left bank.

During the driest time of the year, the stretch of river between Yenangyaung and Nyaungu is always difficult. Many flat islands, which nearly cover in the freshets, and numerous sandbanks, divide

Chart 70.

Chart 2136.

the river into several channels. The navigable channels are constantly shifting and in a normal low water season, shoal to 5 feet (1^m5). Except for a few good stretches of river, the channels in this section are mostly narrow and intricate, approaching close to the rocky banks on either side. Some of the bends of the channel in this reach are very sharp, turning almost straight across the river. About 10 miles above Yenangyaung and again above Chauk, low hills run close down to the river bank. The width of the river in this stretch averages about 2 miles; the greatest width is between Pakanng and Sale, about 9 miles northward, where it is nearly 4 miles between the main banks. About 28 miles eastward of Sale, a solitary mountain named Popa, rises abruptly, and is visible from Magwe (Lat. 20° 17' N., Long. 94° 42' E.), as far as Myingyan.

In recent years the river near Sinbyugyun has changed its course from the right to the left bank. There are several beds of shingle in this area, and during March and April, 1939, the channel shoaled to 3 feet 9 inches (1^m1) for short periods. Groundings were frequent and it was only with great difficulty that vessels got through this shoal channel. Except for the rocky banks and a few very large snags in the river below Sinbyugyun, there are no navigational dangers in this reach; these snags are now under the sand. Nyaungu is 478 miles from Rangoon.

Including stops at calling places, the express steamers take a little over a day to do the run between Yenangyaung and Nyaungu. The cargo steamers take about a day and a half to do the same run. The time down, and including stops, is the same as the upward run.

From Nyaungu to Sameikkon is 61 miles. It is an unimportant large village on the left bank, and is the eighth pilot station. There are two important towns in this reach. Pakokku on the right bank had, in 1931, a population of 23,115, and Myingyan on the left bank 25,457. Pakokku, 16 miles above Nyaungu, is the district headquarters and the main river terminal station for the Irrawaddy Flotilla Company's Chindwin river service. The greater part of this reach is difficult. Central islands, which are cultivated during the dry season, and sandbanks extend along the whole length of the river between Nyaungu and Myingyan. Tagaungde rocks extend about 6 miles along the left bank to Letpanchibaw, almost opposite Pakokku. These rocks, many of which dry, extend in some cases nearly 400 feet (121^m9) out from the bank. Usually the main channel runs close to them and is narrow, and great care is necessary in navigating this section when descending the river. During the dry seasons, between 1932 and 1937, the channels into Pakokku deteriorated, those northward and southward of the large central island off the town, shoaling to 3 feet (0^m9), and were very narrow and tortuous. For 5 months during each of these years the main line steamers were unable to approach Pakokku. Since 1937 the channel southward of the island has opened out and all vessels now call at Pakokku. During the wet season the channel northward of the island is opened for the passage of all vessels.

Immediately above Pakokku there is a large outcrop of rock lying off Shwekyauung chaung, which extends about 400 feet (121^m9) from the right bank and parts are exposed during the dry season. At Kunywa, about 4 miles above Pakokku there are extensive rock for-

Chart 70.

Chart 2136.

mations which extend for about a further 4 miles up stream. The channel over this rock area varies, and when it crosses to the left bank, it is an intricate one, being narrow and tortuous, requiring careful navigation when descending the river. When the channel passes westward of the large central outcrop, which dries, it is not so difficult, being much wider and almost straight. From time to time the channels through this rock area have been improved by the removal of rock. In the dry season of 1940 the main channel passed westward of the central outcrop, and the least depth found over the rocks in the channel was 7 feet (2^m1).

Between a position about 4 miles above Kunywa and Myingyan (Lat. 21° 26' N., Long. 95° 21' E.), the bed of the river is sand. The current is usually very sluggish immediately above the rocks, and the channels are usually tortuous and often shoal to 5 feet 3 inches (1^m6).

Myingyan on the left bank and 23 miles above Pakokku, is the district headquarters and is connected to the general railway system.

Flat islands, which are cultivated, and sandbanks off the town, prevent vessels berthing within 2 to 3 miles of it during the dry season. During the freshets, narrow channels above and below the town, allow vessels to get much closer to Myingyan.

From Myingyan to Sameikkon is about 22 miles. This is a narrow reach of the river, in places only about a quarter of a mile wide. The banks are hard and resistant to erosion. There are no central islands or sandbanks in this section, but there are several outcrops of rock near Myedaw, 8 miles above Myingyan, known as The Drunken Sailor rocks. The channel through them during the driest time of the year is about 9 feet (2^m7), but is narrow, and passes close to the right bank. There are a few other isolated patches of rock in this reach and also at Nagabauk, 1½ miles below Sameikkon. These rocks have a depth of less than 5 feet (1^m5) over them, but the channel is wide and they are not considered dangerous to navigation.

Chart 70.

Sameikkon to Mandalay, 58 miles, on the left bank. Mandalay is a city with a population, in 1931, of 134,950 and is the ninth pilot station. Above Sameikkon, the river widens out again and is divided by many central flat islands, most of which are cultivated, and sandbanks. For the first 9 miles of this section the channels are very changeable during the dry season, sometimes shifting three or four times a week; they are always narrow and intricate and depths of 4 feet 9 inches (1^m4) can be expected in them; for short periods they have been known to shoal to 4 feet 2 inches (1^m3).

About 19 miles above Sameikkon is Myinmu, a town on the right bank with a population, in 1931, of 5,072. From a northerly course the river bends sharply almost due east here. Above and below the landing place there are outcrops of rock lying well out from the right bank, one of which, below the landing place, dries. On the left bank and 8 miles above Myinmu, is Ngazun. The dry season channel, which is towards the right bank, and almost opposite the town, passes over an extensive rock formation. There is quite a good channel through these rocks and there is a depth of 7 feet (2^m1) over them, but many of the rocks outside the channel have less than 3 feet (0^m9) over them.

About 21 miles above Ngazun there is another extensive rocky area called Kabanee; these rocks extend from the right bank to

Chart 70.

Chart 70.

almost two-thirds across the river. In 1940, the channel over the rocks was very narrow and tortuous.

Near Ava on the left bank, is another rock outcrop lying well out towards the centre of the river with several wrecks on it. The channel passes westward of the rocks and is usually wide and deep.

Ava is situated in an angle, where the river turns from eastward to northward in the direction of Mandalay; the remains of the old city lie on an island, artificially formed by a channel between the Myitnge and the Irrawaddy rivers.

The Myitnge river enters the Irrawaddy through the left bank above Ava (*Lat. 21° 50' N., Long. 96° 00' E.*) and is navigable for a few miles by small vessels with a draught of about 5 feet (1^m5).

About 9 miles below Mandalay is Sagaing on the right bank with a population, in 1931, of 14,127 and the headquarters of the district of the same name. A low range of hills, running northward and southward, and visible from Myinmu, terminates half a mile above Sagaing point. These hills come close down to the right bank, and rise to a height of about 800 feet (243^m8). On the eastern slopes, facing the river, there are many pagodas and monasteries.

At Sagaing, which is connected with the general railway system, Ava bridge crosses the river from Amarapura to Sagaing; it has four middle spans, each 350 feet (106^m7) wide, reserved for the passage of power vessels, and its height is 40 feet (12^m2) above the highest known level when the Mandalay gauge recorded 228 feet (69^m5) above sea level.

Above Sagaing, the river widens and there are several large islands and sandbanks lying in the middle of this reach. At high flood these islands are covered and only the trees and villages on piles can be seen showing above water. In the dry season these islands are cultivated. The channels in this reach are usually narrow and tortuous in the dry season, requiring careful navigation. In a normal season depths of 5 feet (1^m5) on the various bars is usual, but in some seasons the channels in this section have been known to shoal to 4 feet 3 inches (1^m3).

The total distance from Rangoon to Mandalay is 597 miles.

UPPER IRRAWADDY.—Mandalay to Bhamo.—The 277 miles of the Irrawaddy between Mandalay and Bhamo is normally navigable throughout the year by vessels up to 250 feet (76^m2) in length, towing flats. Between December and April, bars at widely spread intervals, may limit draughts occasionally to as little as 3 feet 8 inches (1^m1).

From Mandalay to Singu, a distance of about 48 miles by dry season channels, the general trend of the river is northward. The right bank is almost straight, with low hills descending nearly to the water's edge. The left bank is low, marshy and intersected by numerous creeks. The river is in places nearly 3 miles wide but is obstructed by islets and sandbanks, through which, during the dry season, a narrow channel winds tortuously, with crossings often carrying no more than a depth of 4 feet (1^m2). When the river is high the channel lies along the right bank.

Chart 748b.

From Singu the trend of the Irrawaddy continues northward, and

Chart 748b.

Chart 748b.

close above the village it narrows in the lower or third defile between densely wooded low hills. The banks are steep and in most places rocky; the centre is deep and clear. On the right bank at the lower end of the defile, is Kyaukmyaung village. Vessels may berth safely 5 opposite a white bungalow; immediately above and below are rocks. On the left bank, 27 miles higher, is Thabeikkyin.

When the river is in flood a very strong current sets down this defile, and vessels proceeding up river should take advantage of slack water in the lee of promontories. 10

At Male, 10 miles above Thabeikkyin, the river widens above the defile. Wooded hills from 800 to 1,150 feet (243^m8 to 350^m5) high, run down to the water on the right bank. The flat left bank is inundated during floods. A spur of the Shan hills, descends from 6,020 feet (1834^m9) at Shweudaung opposite Male (*Lat.* 22° 48' N., 15 *Long.* 95° 55' E.), and runs parallel with the river about 7 miles inland.

The 40 miles from Male to Tagaung, a small village on the left bank, normally present no difficulties, although shoal crossings may develop during the dry season; the bank abreast the village is rocky. On the right bank, 24 miles higher, is the large village of Tigyang. 20 In the dry season troublesome shoals may form just above this village. The dry season channel usually runs through a narrow gully westward of a large island 14 miles above here.

At Inywa, 22 miles above Tigyang, the Shweli or Nan Mao river enters through the left bank. When in flood the Shweli is normally 25 navigable by shallow draught launches for 102 miles, to the village of Myitson. Katha, situated on the right bank 20 miles above the Shweli confluence, is headquarters of the district of that name. It is connected to the general railway system.

About 10 miles above Katha the banks diverge, and for 6 miles, 30 to the village of Moda on the right bank, lie from 2½ to 3 miles apart, but the navigable channel, lying usually towards the left bank, is narrowed by islands which have formed in the river.

From Moda the Irrawaddy trends gradually eastward and then south-eastward for 28 miles to Shwēgu village, off which lies Kyundaw 35 island. About 4 miles above Shwēgu, the river, still trending south-eastward, narrows in the second defile, where it cuts through a range of mountains, from 1,878 to 2,076 feet (572^m4 to 632^m8) high. In three successive bends at its narrowest points, the river trends eastward, north-eastward, and then eastward again. During the freshets 40 a rapid current sets down this defile. It is unadvisable for vessels to tow flats through it when the Bhamo river gauge reads 30 feet (9^m1) or higher, both because of difficulty in manœuvring a flat against the current in the narrows, and the dangerous sluggishness which it imposes when negotiating the bends while proceeding down 45 river. Depths of 23 fathoms (42^m1) have been recorded in the second defile. At one place here the cliff rises 600 feet (182^m9) sheer from the water.

Just above Sinkan, a village at the head of the defile and 18 miles from Shwēgu, the Irrawaddy widens its channel through a broad 50 plain. During the dry season the navigable channel, for the remaining 22 miles to Bhamo, flows among sandbanks, making repeated crossings which may shoal to a depth of 3 feet (0^m9) and where occasionally navigation may be temporarily blocked to all but small

Chart 748b.

Chart 748b.

vessels. Snags, which may be found in any shallow reach above the third defile, are here especially common.

The town of Bhamo in lat. $24^{\circ} 12' N.$, long. $96^{\circ} 52' E.$, lying on the left bank immediately below the confluence of the Taping river with the Irrawaddy, is the headquarters of a civil district. The bazaar area, which lies along the riverside, is threatened by subsidence of the river banks. Government offices and military barracks stand on higher ground eastward.

Immediately behind Bhamo, mountains rise to 6,000 feet (1,828^m8). Above Bhamo, the Irrawaddy is not navigable by large vessels, but small launches may proceed higher, through the first defile, when river conditions permit.

The Taping river is not navigable.

Water.—Except from Katha and Bhamo, well water should be boiled and filtered.

Communications.—The Irrawaddy Flotilla Company operates a regular mail service between Mandalay and Bhamo.

Climate.—**Fogs.**—The Irrawaddy from Mandalay to the third defile shares the climate of the dry zone of Burma. Higher, it is appreciably cooler during winter, and wetter in the rainy season. In the upper reaches the cool season lasts longer, and morning fogs may be expected between November and April.

From December to March, morning fog is prevalent, especially in the delta regions, and in the upper reaches of the river between Mandalay and Bhamo. It usually comes on between 0200 and 0300, but usually disperses before 0900.

Population.—Population is sparse in the upper reaches of the river.

Chindwin river.—Chindwin river, the largest tributary of the Irrawaddy, flows into the main river 10 miles above Pakokku.

From early June until late December the river is navigable by power vessels 130 feet (39^m6) in length, with a draught of 4 feet (1^m2), from its confluence to Homalin, a distance of 387 miles. Small launches may then usually proceed about 120 miles farther, to Singkaling hkamti. Between early June and mid-October, vessels 300 feet (91^m4) long, towing flats loaded to a draught of 6 feet (1^m8), may proceed to Monywa, 60 miles from the confluence, and vessels 130 feet (39^m6) in length with a draught of 6 feet (1^m8), to Pantha, 203 miles farther.

During the dry season from January to May, vessels 130 feet (39^m6) in length with occasional draught restriction as low as 2 feet 8 inches (0^m8) can normally reach Pantha, while smaller craft with a shallower draught may operate to Homalin.

The river is wide, in places dividing into several channels which shoal badly during the dry season. At Alon, 7 miles above Monywa, a reef of volcanic rock extending from the left bank, constitutes a danger when the river is low. Above here the Chindwin flows between low hills of volcanic origin, and 12 miles from Alon pierces them in the Shwezaye gorge. When the river is in spate this narrow gorge contains three strong whirlpools. It should be negotiated at the maximum speed and with great care. Vessels proceeding down river should steer for the centre of the gap, disregarding the throw of the whirlpools, for the set of each is counteracted by the next. Both here and in the Payway gorge, 127 miles higher, vessels with a low

Chart 748b.

Chart 748b.

freeboard should have hatchways closed in case water should sweep the deck when passing through the whirlpools.

The village of Kani, on the right bank, is situated 15 miles above the Shwezaye, and Kin is 30 miles higher on the same bank. The 5
8 miles above this latter village, to Thindaw, are liable to be very shoal in the dry season.

Between Thindaw and Maukkadaw, on the left bank, 14 miles higher, two wide torrent beds enter the left bank. Normally dry, they have steep gradients, and are liable to flood suddenly during 10
the rains, carrying heavy driftwood. Vessels should not anchor off, or close below, these torrent beds in the rainy season.

From Maukkadaw to Mingin, on the right bank, 18 miles further, hills 300 feet (91^m4) high converge and form a minor defile, through which the river flows northward and eastward in a wide bend before 15
resuming its northerly trend. Midway, a hairpin bend at Pindin requires care during floods, as there is a strong set towards the cliffs on the outside of the bend. At Mingin, the small Patolon chaung enters through the right bank.

After broadening at Mingin, the river 14 miles above there, narrows 20
for 29 miles through a defile to Kalewa. At the lower end of this defile Taungdwin chaung enters from the right bank at Chaungwa village. Just below Kalewa, the Chindwin is constricted at Payway gorge, in an acute hairpin bend around cliffs which rise to an elevation of about 1,000 feet (304^m8) above sea level. During floods the current 25
sweeps round this bend at a great rate, forming many whirlpools. Vessels proceeding down river should steer close for the point of the hairpin, maintaining maximum speed, in order to avoid being set on to Anvil rock, which lies in mid-stream. Close watch should be kept for drifting logs which may be held in the vortices of whirl- 30
pools.

The small town of Kalewa stands on the right bank, on a spit at the confluence of the Chindwin with the Myittha river, its chief tributary. The Myittha enters through a narrow defile between mountains, 2,700 feet (823^m0) high. 35

During floods the Myittha has been navigated by small launches for 18 miles, to Kalemmyo town. While a launch is at Kalemmyo, the river level should be watched closely, for the rise and fall is rapid, and an unexpected fall may trap a launch above the rapids, which are 7 miles from the confluence. 40

For 96 miles above Kalewa the Chindwin skirts mountains ranging to 3,200 feet (975^m4) high, which in places descend steeply to the right bank. At some points it narrows where there are cliffs on the left bank. At Masein, 16 miles above Kalewa, a sharp bend causes a whirlpool to occupy the full width of the stream during floods. 45
Vessels should keep to the left bank, beside the village, to avoid the vortex where driftwood gathers. For 4 miles below Mawlaik, which lies 22 miles above Masein, the river may be very shoal during the dry season, and its bed littered with snags. These are usually buoyed until lifted, but an unbuoyed snag near the surface may be detected 50
by a V-shaped ripple above it. Pantha, on the left bank, is situated 18 miles above Mawlaik.

During the dry season very shallow crossings usually form immediately above Mawlaik and below Pantha.

Chart 748b.

Chart 748b.

The Yu river enters through the right bank at Yuwa, 9 miles higher ; during floods it is navigable by small launches for a few miles.

Close above Sittaung, 29 miles above Yuwa, the mountains recede 5 from the right bank, and for 28 miles to Thayaung the river broadens and flows through a plain, near the head of which is the large village of Paungbyin on the left bank. For the remaining 58 miles to Homalin, mountains again converge on the right bank, rising to an elevation of 6,056 feet (1,845^m9) in Kassom, about 15 miles north-westward of 10 Homalin ; this mountain is occasionally snow-capped in January. From below Homalin, Sarameti, 12,557 feet (3,827^m4) high, the highest mountain in Burma, is visible.

Population, which becomes thinner as one progresses up the Chindwin, is here very sparse. Apart from small widely spread apart 15 villages and cultivated clearings, the banks are covered with dense jungle.

Immediately below Homalin the Uyu river enters the Chindwin on the left bank through an alluvial plain. During the rainy season it is navigable by small launches for about 28 miles, to Maingkaing 20 village. Navigation of the final reaches to Homalin normally presents no difficulty, although shoals may form at the Uyu confluence.

Rise and fall.—Reaching in July or August its normal highest level of between 42 and 47 feet (12^m8 and 14^m3) by the Homalin river gauge, by March the Chindwin may fall to 11 feet (3^m4) by the same 25 gauge. At some points during the change of seasons a rise or fall of a foot (0^m3) in an hour may be experienced. Regard should be given to this when mooring or anchoring a vessel for the night.

Pilotage.—A service of experienced native pilots is maintained by the Irrawaddy Flotilla Company, operating on beats between 30 Pakokku and Homalin.

Communications.—The Irrawaddy Flotilla Company operates a regular service from Pakokku to Homalin. There is also a regular service between Pakokku and Monywa, and between Monywa and Mawlaik.

35 Monywa and Alon are connected to the general railway system.

Climate.—The lower Chindwin shares the climate of the dry zone of Burma. Above Kalewa it is colder than the plains of Burma between November and February, when thick fogs may lie until 1000. During March, the Chindwin between Pantha and the 40 Shwezaye, lies under a pall of smoke, due to the burning of jungle undergrowth. Above Sittaung, during the rainy season from June until September, Himalayan rain-forest conditions prevail.

Chart 823.

GULF OF MARTABAN (*continued from page 372*).—**Grove point** 45 **to Tounzoun point.**—**Coast.**—The coast between Grove point (page 374) and the mouth of the Sittang river about 36 miles north-eastward at the head of the Gulf of Martaban, is low and fronted by an extensive bank of mud and sand. On the eastern side of the Gulf, about 59½ miles eastward of Grove point, is the mouth of Dare- 50 bauk river, the northern outlet of the Salween river (page 399).

The coast northward of the mouth of Darebauk river is also low, but about 9 miles inland is the Zingyaik range of mountains which runs roughly parallel with this coast, and the peaks of which are

Charts 830, 70.

Chart 823.

sometimes visible from a distance of more than 50 miles ; there are several pagodas on the summits of these mountains, the northernmost peaks of which are the highest.

The mouth of Salween river lies about 21 miles south-south-eastward of the mouth of Darebauk river, the two mouths being separated by Bilugyun island. 5

Shoal banks, the outer edges of which are steep-to, extend as much as 4½ miles westward of the northern part of Bilugyun island and about 6 miles southward of Tounzoun point (*Lat.* 16° 14' N., *Long.* 97° 32' E.), its southern extremity which forms the northern entrance point of Salween river. A range of wooded hills, about 500 or 600 feet (152^m4 or 182^m9) high, runs in a northerly and southerly direction throughout the northern part of Bilugyun island and there are several lower and detached hills in this part of the island. 15

Tidal streams.—The general directions of the tidal streams are shown on the inset on chart 823. The rates of the stream at springs increase from 2 to 3 knots in depths of over 20 fathoms (36^m6) to from 6 to 7 knots in lat. 16° 15' N.

During, and immediately after the South-west monsoon, the duration and rate of the outgoing stream are increased and those of the ingoing stream are correspondingly decreased. 20

At springs, the period of slack water does not exceed half an hour.

Chart 70.

Sittang river.—The entrance to Sittang river is at the head of the Gulf of Martaban ; it is only entered by local craft. 25

Sittang river, sometimes named Paunglaung or Tougoo, rises eastward of Yamethin district, in about lat. 20° N., and, winding through Tougoo district, flows into the Gulf of Martaban, after a course of about 350 miles. 30

A bore sweeps up Sittang river at spring tides ; following it, and reported to be as dangerous as the bore itself, is a chopping sea of sand mixed with the water. The Sittang has an enormous quantity of silt in its water. 35

Chart 1845.

SALWEEN RIVER AND APPROACHES.—**Aspect.**—From its entrance, the southern outlet of Salween river extends about 21 miles northward to its junction with Darebauk river, abreast the town of Moulmein. This part of the river is also known as Moulmein river. 40

Moulmein river is entered between Tounzoun point and a bluff point, 60 feet (18^m3) high, about 9 miles southward. Tounzoun point is the extremity of a ridge, 170 feet (51^m8) high, near its northern end, which slopes towards the point. There are several pagodas in the vicinity of Tounzoun point, of which Kwanhla pagoda, about 1½ miles east-north-eastward, situated on a hill 183 feet (55^m8) high, together with two other pagodas on the southern coast of Bilugyun island, about 8 cables eastward of Tounzoun point, form good marks when approaching the entrance. 45

An old pagoda stands on the southern entrance point and the village of Amherst or Kyaikkami is situated close within it ; southward of the point, the coast consists of low cliffs. The Water pagoda, a prominent building on piles, stands on a drying reef about one cable 50

Charts 3481, 823, 830, 70.

Chart 1845.

north-north-westward of the southern entrance point, and a small pagoda which is surrounded by the sea at high water, is situated close to a cliffy point, 40 feet (12^m2) high, about one mile southward of the
 5 same point. See view on chart 1845.

Green island (*Lat.* 16° 04' N., *Long.* 97° 33' E.), about one mile south-south-westward of the southern entrance point, is covered with trees and brushwood, with a clump on its summit; it is surrounded by a bank on which are rocks and boulders and should not be
 10 approached within a distance of half a mile.

Light.—Signal station.—A light is exhibited at an elevation of 135 feet (41^m1) from a masonry tower, painted in red and white horizontal bands, 65 feet (19^m8) in height, situated on the summit of Green island.

15 A signal station with a flagstaff with which vessels can communicate by the International Code of Signals, is situated on the southern entrance point of Salween river.

Caution.—Considerably less depths than are shown on the chart were reported in 1933 to exist in the approaches to Salween river.

20 **Dangers in approach.—Light-vessel.**—In 1924, a shoal with a depth of 36 feet (11^m0) over it, was reported in a position about one mile south-westward of Green Island lighthouse.

Longstones reef lies about 1 $\frac{3}{4}$ miles north-westward of the southern entrance point and consists of a number of rocky patches with moderate
 25 depths between them; the outer rocks dry 9 feet (2^m7) and Devil's Horn, about half a mile south-eastward, dries 12 feet (3^m7). Except at slack water, the channels between the rocks should not be attempted without local knowledge, even by a boat.

A wreck, visible about half-tide, lies on the southern side of Long-
 30 stones reef.

The Patch, which lies about half a mile south-westward of the outer end of Longstones reef, and about 1 $\frac{3}{4}$ miles west-north-westward of the southern entrance point, has depths of less than 6 feet (1^m8) over it and a detached shoal with a least depth of 27 feet (8^m2) over
 35 it, lies about one mile west-south-westward of The Patch.

A light is exhibited, from a light-vessel, painted red with "Goodwin" in white letters on the sides, moored about 3 miles west-north-westward of the southern entrance point of Salween river. The position of the light-vessel is liable to be altered without notice and mariners
 40 are warned not to close her within a distance of 2 miles without a pilot.

Pilotage.—Beacon.—Pilotage is compulsory for merchant vessels of more than 200 tons.

In consequence of the great changes which invariably occur after every monsoon in the channels, banks, and river bed, and owing to
 45 the rapid tidal streams setting in places across the channel, entrance into Moulmein river should not be attempted without a pilot, who can be obtained at Amherst.

The pilot station is at the southern entrance point, and a pilot will be sent off on the usual pilot signal being made by day, or if a *blue*
 50 light is burnt at night, but entrance into the river is impracticable except during daylight.

It is advisable to arrive at the outer anchorage, *see* below, about 2 hours before high water at Amherst, and to anchor there whilst awaiting the pilot.

Charts 3481, 823, 830, 70.

Chart 1845.

The Pilot beacon, consisting of a wooden mast surmounted by a corrugated iron daymark, painted white, 16 feet (4^m9) in height, stands at an elevation of 14 feet (4^m3) on a flat rock, situated about 1½ cables south-westward of Water pagoda. A light is exhibited 5 from a bracket on the top of the beacon. The beacon is for the use of pilots only.

Outer anchorage.—The best anchorage and the most convenient position for pilots to board vessels at all seasons, is in depths of from 9 to 10 fathoms (16^m5 to 18^m3), mud, with Green Island lighthouse 10 bearing 046°, distant 12 cables. The holding ground in this anchorage is not good, and vessels are liable to drag.

Off the southern entrance point and in the vicinity of Longstones reef, the bottom is foul and the holding ground bad; the tidal streams are also very strong. 15

Chart 823.

Directions.—Vessels bound for Moulmein river from westward should pass about 6 or 8 miles southward of Krishna light-vessel (page 371) and thence shape a course for Double island (page 407), about 11 miles southward of Green island (*Lat. 16° 04' N., Long. 97° 33' E.*). 20
Charts 1845, 3481.

As the land near the entrance to Moulmein river is seldom seen from a greater distance than half a mile during March, a landfall must be made well southward and the position off Double island must be ascertained before shaping course for the river entrance. 25

In clear weather and often on a bright moonlight night, the high mountains in the interior eastward of Double island may be sighted before Double Island lighthouse or its light.

In consequence of keeping too far northward in fogs, vessels have frequently run aground on Bilugyun sands, about midway between 30 Tounzoun point and Amherst village; soundings give no warning of approach to these banks, which are steep-to.

In thick weather and during the South-west monsoon, if doubtful of the position, vessels should keep well southward and make the land a little southward of Kalegauk island (page 408), situated about 35 18 miles southward of Double island. With bad weather, especially at or near spring tides, vessels should not proceed to the anchorage off Green island, but should pass inside Kalegauk island and anchor in Bentinck sound (page 409).

Having made Double island, course should be shaped to pass a convenient distance westward of it, and Double island lighthouse should 40 be kept bearing less than 153° until Green Island lighthouse bears 048°, when the outer anchorage may be steered for on the latter bearing.

When proceeding from Rangoon to Moulmein, great care must be exercised to make due allowance for the great strength of the 45 tidal streams. Although vessels must sound constantly, it must be borne in mind that soundings do not give warning of the near approach to the rocks and shoals which extend off the coast on the eastern side of the Gulf of Martaban.

In fine clear weather, a lofty and sharp conical peak in the Zingyaik 50 range (page 398), the high land of Bilugyun island and Sin taung (page 407), about 4½ miles south-eastward of Amherst village, may all be identified on approaching the entrance to Moulmein river. In thick weather, especially in February, March and April, it is advisable

Charts 823, 830, 70.

Charts 1845, 3481.

to make the land between Button islet, situated about $3\frac{1}{2}$ miles south-south-eastward of Green island (*Lat.* $16^{\circ} 04' N.$, *Long.* $97^{\circ} 33' E.$), and Setsē Yēlē Paya (page 407), about 4 miles farther south-south-eastward.

5 *Chart 1845.*

Entrance.—Depths.—Dangers.—The entrance to Moulmein river is much encumbered by extensive drying sandbanks and reefs. The river is usually navigable as far as the town of Moulmein by vessels with draughts varying from 13 feet (4^m0) at high water neaps to 23 feet
10 (7^m0) at high water springs. These draughts depend not only on the season of the year, but on the depths over, and the position in the river of, the dominating bar. Vessels with speed of less than 10 knots are liable to find the depths available to them decreased.

Drying banks of mud and sand with shoals seaward of them, lie
15 within about $3\frac{3}{4}$ miles south-south-westward of the extremity of Tounzoun point. Bilugyun sands, which dry from 2 to 6 feet (0^m6 to 1^m8) in places, occupy a large part of the middle of the entrance, being separated from the shoals which lie southward of Bilugyun island by a channel which is sometimes narrow and shallow and at
20 other times wide and deep; when in the latter state it forms the main entrance to the river. The seaward side of Bilugyun sands is steep-to and soundings give no indication of a near approach to them.

Bilugyun channel, which is the main entrance channel, normally lies between Bilugyun sands and Goodwin sands; the latter sands lie
25 north-eastward of Longstones reef and near its outer end and consist of patches which dry from one to 8 feet (0^m3 to 2^m4); farther north-eastward, the drying sands almost completely fill that part of the river between Bilugyun channel and the eastern shore.

Channels to Moulmein town.—Caution.—Buoys.—The various
30 channels and crossings between Bilugyun channel and Moulmein harbour are subject to constant change and no detailed description of them would be of use to mariners. The navigable channel may pass eastward or westward of Hintha kyun, a large island the southern part of which lies about $3\frac{1}{2}$ miles east-north-eastward of Tounzoun
35 point; on either side of Shwetaung kyun (New island), situated about one mile eastward of the northern part of Hintha kyun; and westward of Yele kyun, about $2\frac{1}{2}$ miles northward of Hintha kyun. In 1953, it was reported that a new island, locally known as Brand New island, had formed close southward of Shwetaung kyun.

40 In 1948, Bilugyun channel passed between Bilugyun and Goodwin sands and had a least depth of 23 feet (7^m0) in the fairway.

The various channels and crossings between the river mouth and Moulmein harbour are buoyed in accordance with the uniform system,
see page 36, with red conical buoys on the starboard hand and black
45 can buoys on the port hand.

The buoys on either side of the channel are numbered consecutively inwards and each buoy has the initial letter of its channel painted on it; the positions of the buoys are not to be relied on.

Anchorage.—Mooring buoys.—There are anchorages at several
50 places in the river but vessels must moor as in no case can they lie at single anchor.

Half-way anchorage, a berth for two vessels of not more than 450 feet (137^m2) in length, is situated in a depth of 30 feet (9^m1) off Anchoring creek, which lies at the northern end of Long Island channel and east-

Charts 823, 830, 70.

Chart 1845.

ward of the southern point of Hintha kyun (*Lat. 16° 15' N., Long. 97° 36' E.*).

Charts 1646 and 1845.

Mupon anchorage lies off the suburb of Mupon, situated at the southern end of the town of Moulmein. There are three mooring buoys here, each of which can accommodate a vessel 500 feet (152^m4) in length with a draught of 30 feet (9^m1). Southward of the mooring buoys, there is an anchorage berth for one vessel of 450 feet (137^m2) in length and draught of 20 feet (6^m1). 5

In April, 1931, a vessel 605 feet (184^m4) in length was berthed off Mupon in a least depth of 28 feet (8^m5). 10

Moulmein anchorage is situated abreast the town of Moulmein, about 3½ miles northward of Yele kyun. There are two mooring buoys, one capable of accommodating a vessel 450 feet (137^m2) in length and 19 feet (5^m8) draught, and the other, a vessel 400 feet (121^m9) in length and 19 feet (5^m8) draught. There is also an anchorage berth for a vessel 400 feet (121^m9) in length and 19 feet (5^m8) draught. 15

At Kaladan (Kalladan) anchorage, abreast the northern part of the town of Moulmein, there is an anchorage berth for one vessel of 400 feet (121^m9) in length and 23 feet (7^m0) draught. 20

Chart 1845.

Tidal semaphores.—There is a tidal semaphore, 80 feet (24^m4) high and painted white, near the southern end of Hintha kyun; it is visible southward from Bilugyun channel and northward from abreast the northern part of Hintha kyun; in 1953, it was reported as unwatched and in a state of decay. There is a semaphore 80 feet (24^m4) high and painted red, at Natmhaw, situated about one mile west-south-westward of Yele kyun, which is visible from the southern end of Amelia crossing about 2 miles eastward of the southern extremity of Hintha kyun; and there is another semaphore, 50 feet (15^m2) high, at Thetkaw, about 2 miles above Natmhaw; it is painted white and is visible southward from abreast the northern part of Hintha kyun and northward from the berths off Mupon. The system is the same as that employed in Karnaphuli river, *see* page 241; they register the rise of the tide between daylight and dark. 25 30 35

Charts 1646, 1845.

Tide gauges.—There are two permanent tide gauges in the river; one abreast Natmhaw point and the other on the eastern side of the harbour, about 6½ miles north-north-eastward of Natmhaw point and about 6 cables southward of Mission Street jetty (*Lat. 16° 29' N., Long. 97° 37' E.*). The zero of each of these gauges is set to Indian spring low water mark, the datum of the soundings on the charts. In addition, each bar has its own particular gauge, but the position of these is not to be relied on, as they are shifted in accordance with the alterations in the positions of the bars. 40 45

These gauges are painted in red, black and white sections. Each of the red and white sections is a foot (0^m3) in depth, the top of the red colour indicating one fathom (1^m8) and the top of the white half a fathom (0^m9). The intervening space of 2 feet (0^m6) is painted black with narrow white lines across the middle, dividing it into two equal portions of one foot (0^m3) each. 50

Chart 1845.

Tidal streams.—In the offing abreast Amherst the north-going

Charts 823, 830, 70.

Chart 1845.

stream commences about one hour before low water at Elephant point (see predictions in Admiralty Tide Tables), and the south-going stream about one hour before high water there ; the streams run at $3\frac{1}{2}$ knots
 5 at springs and there is a very short period of slack water.

Near the entrance to Moulmein river, the north-going tidal stream sets towards Longstones reef, and when the outer banks are covered, it sets strongly eastward or north-eastward over the sands. The south-going tidal stream gradually turns to west-south-west. During
 10 the South-west monsoon and immediately afterwards, the duration and rate of the south-going stream are increased, and those of the north-going stream correspondingly decreased. In the river during the dry season the greatest rate of the stream is about 3 knots, but in the rainy season the outgoing stream attains a rate of 7 knots.

15 During the dry season, the streams turn approximately as follows :—
 Off Green island, the north-going stream begins $1\frac{1}{2}$ hours before low water at Elephant point, and the south-going stream one hour before high water at Elephant point (*Lat. $16^{\circ} 28' N.$, Long. $96^{\circ} 20' E.$*).

At the entrance to Bilugyun channel, the ingoing stream begins at
 20 about low water at Elephant point, and the outgoing stream begins shortly before high water at Elephant point.

At Anchoring creek, on the eastern side of the river abreast the southern end of Hinthia kyun, the ingoing stream begins about one hour after low water at Elephant point, and the outgoing stream just
 25 after high water at Elephant point.

At Natmhaw, the ingoing stream begins one hour and 40 minutes after low water at Elephant point, and the outgoing stream about 0 hr. 20 m. after high water at Elephant point.

Chart 1646.

30 Off Moulmein the ingoing stream begins 2 hrs. after low water at Elephant point and the outgoing stream about 0 hr. 30 m. after high water at Elephant point.

The local authorities state that the durations of the ingoing and outgoing streams are the same all the year round at Amherst, but at
 35 Moulmein their duration is approximately : October to January, 4 hours ingoing, 8 hours outgoing ; February to May, 5 hours ingoing, 7 hours outgoing ; June, 3 hours ingoing, 9 hours outgoing ; July to September, no ingoing except at springs.

Charts 1646, 1845.

40 **Quarantine.**—See quarantine regulations on page 40.

There must not be any communication between any vessel, which is liable under the above regulations to display flag “ L ” of the International Code of Signals, and the shore or any other boat or vessel, except to receive the pilot and his servant and baggage, until per-
 45 mission is granted in writing by the Health Officer.

If there is a suspected case of plague on board, or if more than two deaths from any cause have occurred during the voyage, the pilot anchors the vessel in Half-way anchorage to await the Health Officer ; in other cases vessels are anchored in the lower end of Mupon reach.

50 Vessels which have, within a period of two months immediately preceding their arrival, started from or touched en route at a port infected with yellow fever, or communicated (except orally without contact, or by signal) with a vessel which is either infected with yellow fever or which has left a yellow fever infected port within
 55 that period, shall be allowed to anchor only at one mile south-westward of Green island.

Charts 823, 830, 70.

Chart 1646.

MOULMEIN HARBOUR. — Dangers. — Buoys. — Moulmein harbour extends between a position about $2\frac{3}{4}$ miles northward of the northern point of Yele kyun, and Battery point, situated on the eastern side of the harbour about $2\frac{1}{2}$ miles farther northward. The 5
harbour is in charge of a Port Officer.

Mupon reef, on which are patches of rock which dry 2 feet (0^m6) at low water during the dry season (February and March), lies about half a mile northward of Mupon pagoda, situated about $1\frac{1}{2}$ miles north-north-eastward of the northern point of Yele kyun. 10

Sirrocca rock, with a least depth of 8 feet (2^m4), lies nearly in mid-river, about 11 cables northward of Mupon pagoda and about 4 cables from the eastern shore. A red conical buoy, marked "S.R." in white letters is moored about $1\frac{1}{2}$ cables north-north-eastward of the shoalest part of Sirrocca rock and marks the eastern side of the channel. 15

Wales rock, with a least depth of 4 feet (1^m2), lies about $1\frac{1}{2}$ miles northward of Mupon pagoda and about three-quarters of a cable off the eastern shore. A rocky patch with a least depth of 11 feet (3^m4) lies about one cable north-westward of Wales rock; a red conical buoy, marked "W.R." is moored close northward of this patch. 20

Castle rock, with a depth of 2 feet (0^m6) over its southern end, lies about $6\frac{1}{2}$ cables northward of Wales rock and about $1\frac{3}{4}$ cables from the eastern shore.

Town rock, over which there is a depth of 6 feet (1^m8), lies about $3\frac{3}{4}$ cables north-westward of the northern end of Castle rock (*Lat.* 25
 $16^\circ 29' N.$, *Long.* $97^\circ 37' E.$). A conical buoy, painted in red and white horizontal bands, is moored close northward of Town rock.

Wharves and jetties.—Mission Street jetty, a pontoon jetty, 176 feet (53^m6) long, is situated about $2\frac{1}{2}$ miles northward of Mupon pagoda; in 1953, a least depth alongside of $14\frac{1}{2}$ feet (4^m4) was 30
reported.

Main wharf, with a depth alongside of 11 feet (3^m4), is situated about 2 cables northward of Mission Street jetty.

Kaladan (Kalladan) jetty, situated about $6\frac{1}{2}$ cables northward of Main wharf, is a pontoon jetty, 162 feet (49^m4) long; it is used only 35
by river vessels.

Between Mupon and Battery point there are several single pontoon jetties for the use of lighters. Prior to the recent hostilities, there were numerous rice and timber mills along the water-front of the town, each with its own small wooden jetty for lighters; in 1945, many 40
of these jetties had been destroyed or damaged by bombing.

Moulmein town.—Port facilities.—The town of Moulmein stands on the eastern bank of the river southward of Battery point and is backed by a ridge of hills about 280 feet (85^m3) high; many of its buildings were badly damaged during hostilities. The Port Office is 45
situated close to the root of Main wharf.

In 1945, the population was estimated at about 61,000 of whom only 20 were Europeans. There is a large community of Anglo-Indians and Anglo-Burmans in the town.

Fresh provisions are plentiful. Fresh water can be supplied by 50
water boat on application to the Port Officer; it should be chlorinated or boiled before use.

Minor repairs can be undertaken. There is a patent slipway, details of which will be found in Appendix I, page 489.

There is a hospital with accommodation for Europeans. 55

Chart 1646.

The principal exports are rice and timber, mainly teak, and the chief exports are hardware and piece goods.

Chart 823.

- 5 Martaban, situated on the right bank of Salween river about $1\frac{1}{2}$ miles northward of Battery point is connected with Rangoon by railway and Moulmein is connected by railway with Ye town (page 414).

Caution.—Deaths from cholera have occurred from drinking the river water; although quite fresh it should not be used.

- 10 **Winds and weather.**—In December, the weather is fine and clear. In January, the mornings and evenings are misty, though the weather is fine. In February light land and sea breezes set in, the land breeze being from east and north-east, the sea breeze from west and north-west.

- 15 In March the land and sea breezes continue, the land breeze being from east and the sea breeze from south-west, the former light, but the latter sets in with strength, and blows fresh at Amherst between 1400 and 1600, after which it dies away.

- 20 Much rain falls between May and September. *See climatic table, page 85.*

- Fogs.**—Fogs become frequent and thick towards the end of February and continue so throughout March. They last for three or four days at a time, obscuring even the banks of the river and making its navigation difficult. The fog is increased by dense smoke from large fires
25 lit by the natives.

Storm and weather signals.—The general system, *see* pages 30 to 32, is in use at Moulmein (*Lat.* $16^{\circ} 29' N.$, *Long.* $97^{\circ} 38' E.$).

Climatic table.—*See* page 85.

Chart 70.

- 30 **Salween river above Battery point.**—About 100 miles from its entrance, Salween river is joined by Thaungyin river; about 10 miles below the junction are the great rapids, which are formed by a bridge of rocks, extending completely across the river, and are impassable in the dry season, even by canoes. About 10 miles farther down the
35 river there are less formidable rapids, but impassable in the rains, and below which the river is encumbered by numerous islands and shoals, which are covered in the rainy season, when the level rises about 30 feet (9m).

- A few miles farther southward it receives the waters of the Yunzalin
40 (Yoonzaleen) from north-westward, and in this vicinity the hills on the east bank recede, those on the west diminish considerably in height, and the river traverses a more open and level country. Limestone rocks, rising suddenly out of the plain into serrated lofty ridges, appear on both banks at intervals.

- 45 Owing to its narrow rocky bed and frequent rapids, it is practically useless for the purposes of through navigation.

There are no bridges over the river in Burmese territory, but it is crossed at intervals by ferries.

Chart 3481.

SALWEEN RIVER ENTRANCE TO HOPE POINT.—**Green island to Bluff point.**—**Coast.**—From the clifty point abreast Green island (page 400), the coast, which is rocky, indented and clifty in places, trends south-south-eastward for about $8\frac{1}{4}$ miles to a point

Charts 823, 830, 70.

Chart 3481.

close off which is Setsē Yēlē Paya, an islet surmounted by a pagoda, 70 feet (21^m3) high. Button island lies about a quarter of a mile offshore nearly midway along this stretch of coast and Sin taung, 934 feet (284^m7) high and wooded, stands about 3 miles east-north-eastward of Button island and forms a very good mark from westward. 5

Between the point abreast Setsē Yēlē Paya and Bluff point, about 12½ miles south-south-eastward, the coast forms a slight bight and, except for a point about 3½ miles east-south-eastward of Setsē Yēlē Paya which is surmounted by a hill 310 feet (94^m5) high and is prominent, the shores of this bight are low and covered with dense jungle. At the head of the bight are the entrances to several creeks, and in its southern part sandflats, which near the shore are covered with mud, dry out for a distance of from 1½ to 1¾ miles. About 1½ miles 15 northward of Bluff point is a pagoda which stands on a small reef connected with the drying flats.

Off-lying island and dangers.—Light.—Double island lies about 4½ miles south-south-westward of Setsē Yēlē Paya. It is steep-to on its western side but rocky ledges with depths of from 2½ to 5½ fathoms (4^m6 to 10^m1) extend about one mile south-south-eastward, and about 2 cables eastward and northward of the island. Landing is difficult in bad weather; the landing place is close to a crane on the eastern side of the island. The channel between Double island and the mainland is clear of danger. 25

A light is exhibited, at an elevation of 140 feet (42^m7), from a white masonry tower, 66 feet (20^m1) in height, situated on the summit of Double island (*Lat.* 15° 52' N., *Long.* 97° 35' E.). There are trees on the island which are the same height as the top of the light-house. 30

North rocks are two detached groups of rocks about 1½ miles apart in a north-north-easterly and south-south-westerly direction, situated about 3 miles north-westward, and a similar distance west-north-westward, respectively, of Bluff point. The north-eastern group dries about 17 feet (5^m2), and the highest rock of the south-western group is 20 feet (6^m1) high. Patches of 4½ and 4¾ fathoms (8^m2 and 8^m7) lie eastward and north-eastward of the northern group, and vessels should pass westward of both groups of North rocks. 35

Caution.—Less depths than are charted have been reported to exist off Double island and this locality should be navigated with caution. 40

In the event of the light-keepers at Double island requiring assistance, they have instructions to darken the light for a short interval when a vessel is sighted and, as fever is prevalent on the island, this occasionally happens and should be reported.

Tidal streams.—The tidal streams in the vicinity of Double island 45 are strong, running at a rate of 4½ knots at springs and about 2 knots at neaps. The stream sets northward with the rising tide and southward with the falling tide, and turns about one hour before high and low water, respectively, at Elephant point (*see* predictions in Admiralty Tide Tables); there is a very short period of slack water. 50

Bluff point to Hope point.—Coast.—Between Bluff point and Pagoda point, about 8½ miles south-south-eastward, the coast is mostly sandy with a few rocky points fronted by mud and sand flats with occasional rocky patches; it is backed by thick jungle growing to

Chart 3481.

the water's edge which is broken only at the entrances to Tinyu chaung and Anin chaung, situated about $2\frac{1}{2}$ and $6\frac{1}{2}$ miles, respectively, south-south-eastward of Bluff point.

- 5 Thabut taung, a short ridge of coastal hills from 280 to 420 feet (85^m3 to 128^m0) high, rises about $3\frac{1}{4}$ miles south-south-eastward of Bluff point and thence curves south-eastward for about 2 miles.

- Kakana taung (Pulau Kropit), an islet 180 feet (54^m9) high, lies about $4\frac{1}{2}$ miles southward of Bluff point and about three-quarters of a mile offshore.

- Between Pagoda point and Bentinck point, about 8 miles southward, the coast continues covered with thick jungle, broken at the entrance to Thabye chaung, close southward of Pagoda point, and Kawdud chaung, about $2\frac{3}{4}$ miles north-north-eastward of Bentinck point ;
15 a prominent hill, bare of jungle, stands close to the southern entrance points of these two creeks. Phaungkala taung, 1,290 feet (393^m2) high, is the highest summit in an isolated range about 6 miles east-south-eastward of Pagoda point, and is prominent.

- Kyaikhalaing pagoda stands on a reef about 3 miles northward
20 of Bentinck point and about one mile offshore ; it is connected with the coast by a drying sandflat.

- Between Bentinck point and Hope point, a rocky point surmounted by a small hill 360 feet (109^m7) high about 8 miles southward, the coast forms a bay the shores of which are fronted by drying sand and mud
25 flats which in places extend as much as $1\frac{1}{2}$ miles offshore. Wara taung 1,550 feet (472^m4) high, rises about $5\frac{1}{2}$ miles within the head of the bay and about 8 miles east-south-eastward of Bentinck point (*Lat. $15^{\circ} 29' N.$, Long. $97^{\circ} 44' E.$*).

- Kalegauk island. — Dangers. — Obstruction.** — Kalegauk
30 island lies about $4\frac{1}{2}$ miles off the coast between a point about 2 miles southward of Pagoda point, and Bentinck point. The coasts of the island are mainly cliffs interspersed with small sandy bays and mangrove swamps and are mostly steep to outside depths of 5 fathoms (9^m1), which in no part lie more than half a mile offshore. Near its northern
35 end, the island rises to a summit 600 feet (182^m9) high, known as Mount Woodstock.

- Galloper sand, on which the depths are less than 3 fathoms (5^m5) and which dries in patches, extends about $6\frac{1}{4}$ miles northward from a position about half a mile eastward of Portland point, the northern
40 extremity of Kalegauk island. There are depths of from 6 to 15 fathoms (11^m0 to 27^m4) in the fairway of the narrow channel separating Galloper sand from the northern end of Kalegauk island.

- The Peepers are two small rocks, 2 feet (0^m6) high, lying close together about one mile from the southern extremity of Kalegauk island and
45 about 2 cables off the western coast of the island.

- Cavendish island lies about a quarter of a mile southward of Kalegauk island. Rocks which dry about 15 feet (4^m6) extend a short distance north-eastward from the island and other rocks, which dry 11 feet (3^m4) extend a short distance south-westward of it ; a spit on which
50 the depths are less than 5 fathoms (9^m1), extends about 4 cables southward from the island.

South shoal, with a least depth of 4 fathoms (7^m3) over it, extends about $2\frac{1}{4}$ miles southward from a position about three-quarters of a mile south-westward of Cavendish island ; there are depths of from $5\frac{3}{4}$ to

Chart 3481.

8 fathoms (10^m5 to 14^m6) in a narrow channel which separates South shoal from the spit extending southward from Cavendish island.

In 1945, an obstruction with a depth of $2\frac{1}{2}$ fathoms (4^m1) over it, the position of which is approximate, was reported to exist close eastward of South shoal and about $1\frac{1}{2}$ miles southward of the southern point of Cavendish island. 5

Bentinck sound. — Dangers. — Bentinck sound lies between Galloper sand and Kalegauk island on the west, and the coast of the mainland eastward of them, on the east. There are depths of from $5\frac{3}{4}$ to 9 fathoms (10^m5 to 16^m5) in the fairway of the northern entrance to the sound, which has a least width of about 6 cables, and from 7 to 9 fathoms (12^m8 to 16^m5) in the southern entrance. 10

A $2\frac{1}{2}$ -fathom (4^m6) patch lies on the eastern side of the northern entrance to the sound, about 6 cables westward of the northern end of Kakana taung. 15

Middle ground, with a least depth of $4\frac{1}{2}$ fathoms (8^m2), mud, lies in the middle of the northern part of the sound and extends about $1\frac{1}{2}$ miles north-north-westward with depths of less than 5 fathoms (9^m1), from a position about 2 miles west-north-westward of Pagoda point. 20

Tidal streams.—The tidal streams set through Bentinck sound at rates of from 2 to 3 knots and through its northern entrance at a rate of 5 knots. The north-going stream sets on to the inner side of Galloper sand and the south-going stream on to the other side. 25

Anchorage.—Directions.—Anchorage, especially sheltered during the South-west monsoon, may be obtained in Bentinck sound, in depths of from 6 to 8 fathoms (11^m0 to 14^m6), about half a mile eastward of the middle of the eastern side of Kalegauk island (*Lat.* $15^\circ 32' N.$, *Long.* $97^\circ 40' E.$). 30

The northern entrance, which is about one mile in width between the 5 fathom (9^m1) contour lines, should not be used by deep-draught vessels without local knowledge, as the tidal streams set obliquely and very strongly across the entrance channel and no leading marks can be given after passing the northern end of Galloper sand. 35

Vessels using the northern entrance should approach keeping the southern extremity of Kakana taung bearing 128° and in line with Phaungkala taung, which leads midway between the northern end of Galloper sand and the south-western edge of the shorebank northward of Kakana taung; when the northernmost peak of Thabut taung bears 078° , course should be altered southward to 182° , to pass between Galloper sand and Middle ground, taking care not to be set towards Galloper sand by the north-going tidal stream, or towards Middle ground by the south-going stream. 40

The southern entrance to Bentinck sound is about 3 miles in width between the 5 fathom (9^m1) contour lines. Vessels from westward using this entrance should approach keeping Wara taung bearing not more than 078° ; when the eastern side of Kalegauk island is seen open eastward of Cavendish island, bearing about 002° , course may be shaped to pass about one mile eastward of Cavendish island. 50

Chart 1272.

APPROACHES TO YE RIVER.—Hope point to Damatha taung.—Coast.—From Hope point (page 408), the coast trends

Charts 3481, 823, 830, 70.

Chart 1272.

southward for about $6\frac{3}{4}$ miles to the entrance to a small creek and is cliffy and closely backed by densely-wooded hills; Palein (Phalein), a peak 1,710 feet (521^{m2}) high, rises about 4 miles south-south-eastward of Hope point and forms a very good mark.

Southward of the mouth of the above-mentioned small creek, the steep, rocky and thickly-wooded coast changes to a sandy beach backed by jungle which extends south-south-eastward for about $3\frac{1}{2}$ miles to Pagoda point.

- 10 Pagoda point, a prominent hillock, 151 feet (46^{m0}) high, rising steeply from the beach and surmounted by a small pagoda, is the northern entrance point of Ye river. Sidaw taung, the southern entrance point, about $1\frac{1}{2}$ miles south-eastward of Pagoda point, is a bold headland, 577 feet (175^{m9}) high, which from westward or north-westward, 15 appears flat-topped, but, when seen from southward, appears conical. See view facing page 416.

Between the entrance to Ye river and Damatha taung, a headland 518 feet (157^{m9}) high about $9\frac{1}{2}$ miles southward, the coast is low and sandy and is interspersed by small headlands, but the high ranges 20 inland give it the appearance of being steep.

Chart 3481.

Off-lying islands and dangers.—Kokunye kyun, an island 460 feet (140^{m2}) high, lies about $3\frac{1}{4}$ miles south-south-westward of Hope point and about $1\frac{1}{4}$ miles offshore. A narrow bank, a large part of which 25 dries, extends about 2 miles northward and thence $1\frac{1}{2}$ miles north-north-eastward from the island, its extremity lying about half a mile north-westward of Hope point. A bank on which the depths are less than 5 fathoms (9^{m1}) extends about 6 cables southward from the island.

Chart 1272.

- 30 Toby rock (*Lat.* $15^{\circ} 16' N.$, *Long.* $97^{\circ} 43' E.$), which dries about 17 feet (5^{m2}), lies about 2 miles southward of Kokunye kyun and about 6 cables offshore; it lies on a ridge with depths of $3\frac{1}{2}$ fathoms (6^{m4}) over it.

A chain of shoals with gaps between them, extends in a wide curve 35 for about 30 miles south-westward, from a position about 3 miles south-westward of Toby rock and, closer inshore, a chain of islands extends southward parallel with the coast for about 21 miles from a position about 2 miles west-north-westward of Pagoda point; there are no passages between these islands which can be recommended.

- 40 Livermore shoal is a ridge of sand, with a least depth of 2 fathoms (3^{m7}), situated about $5\frac{1}{2}$ miles west-north-westward of Pagoda point. Pagoda point, bearing 117° , just open north-eastward of Wa kyun, leads north-eastward of Livermore shoal. Soundings provide the best guide when passing seaward of this shoal.

Chart 3481.

Headlam patch, with a least depth of $6\frac{1}{2}$ fathoms (11^{m9}), lies about 8 miles west-south-westward of Pagoda point. Shearme sand, with a least depth of 6 fathoms (11^{m0}), lies about 4 miles south-westward of Headlam patch.

Chart 3624.

Sinclair shoal, with a least depth of 5 fathoms (9^{m1}), lies about 16 miles west-south-westward of the southern end of Shearme sand.

Wa kyun (Stag island), about $1\frac{3}{4}$ miles west-north-westward of Pagoda point, is the northernmost of the chain of islands extending

Charts 3481, 823, 830, 70.

Chart 1272.

southward from off the mouth of Ye river ; it has two summits, the northern and higher being 444 feet (135^m3) high. The western side of the island is steep, and on its eastern side there is a beach. See view facing page 416.

A spit, with depths of less than 3 fathoms (5^m5) over it, extends about 8½ cables north-north-westward from the northern end of the island, and a similar spit projects about half a mile, in a south-easterly direction, from the southern end.

Hngetpyaw kyun (Outer island), about 9 cables south-westward of 10 the southern end of Wa kyun, is wooded. Rocks, which dry about 18 feet (5^m5), lie about 1½ cables north-westward of the northern extremity of the island, and depths of less than 5 fathoms (9^m1) extend about 9 cables northward from the rocks.

Nat kyun (Bath Bun island) lies about half a mile south-eastward of 15 Hngetpyaw kyun (*Lat. 15° 11' N., Long. 97° 43' E.*), at the northern extremity of a ridge of hard sand, which dries from 3 to 4 feet (0^m9 to 1^m2), and extends 3¾ miles southward ; a detached bank, which dries from 2 to 5 feet (0^m6 to 1^m5), lies northward of Nat kyun and, with the shoal which extends northward and eastward from Hngetpyaw kyun, 20 forms the south-western side of the channel which separates these islands from Wa kyun ; this channel has a least depth of 7 fathoms (12^m8) in the fairway, but is not recommended.

Ghorparay rock, which dries 3 feet (0^m9), lies about 4 cables westward of the southern extremity of Nat kyun.

Pascoe shoal, with a least depth of one foot (0^m3), lies about 1½ miles eastward of Nat kyun. In the channel eastward of the shoal there is a least depth of 4 fathoms (7^m3) in the fairway. The eastern extremity of Kokunye kyun (chart 3481) in line with the western extremity of the mainland, 3¾ miles south-south-eastward of it, 30 bearing 339°, leads through the channel.

Kyettaik kyun (Kyetiki gyun), about 1½ miles south-eastward of Nat kyun, is 78 feet (23^m8) high to the tops of the trees. A shoal, with depths of less than 3 fathoms (5^m5), extends about 3 cables south-south-westward from the southern end of Kyettaik kyun.

Simpson shoal extends nearly 3 miles southward from Kyettaik kyun, with depths of less than 5 fathoms (9^m1), and has a least depth of one fathom (1^m8), sand and mud, near its centre. The eastern extremity of Nat kyun in line with the south-western extremity of Wa kyun, bearing 352°, leads through the southern part of the 40 channel between Simpson shoal and the ridge of sand which dries extending southward from Nat kyun. The channel eastward of Simpson and Pascoe shoals is, however, to be preferred. Kyettaik kyun, bearing 351°, open westward of the high land near the coast northward, leads eastward of Simpson shoal.

Kyungyi (Pig island), about 4½ miles southward of Nat kyun, consists of four, distinct, wooded hills, connected by low sandy beaches ; the southern and largest hill is 534 feet (162^m8) high, and steep on its eastern side. Shoals, on which the sea incessantly breaks, extend nearly 1½ miles westward from the island, their extremity forming 50 the end of a narrow ridge, with depths of less than 3 fathoms (5^m5) over it, which extends about 6 miles southward. There are moderate depths immediately eastward of Kyungyi and across to the mainland, forming a good channel and secure anchorage.

Chart 1272.

Da That (Tamarind) island 260 feet (79^m2) high, is situated about 4 miles south-south-eastward of Kyungyi and about 1½ miles offshore ; the deep channel passes close westward of it.

Chart 3624.

Ross sand, which extends about 7½ miles southward, with depths of less than 5 fathoms (9^m1), from a position about 5 miles westward of Da That island, has a least depth of 1½ fathoms (3^m2) over its northern part, and is usually marked by discoloration and tide-rips.

10 Soundings give little warning of the approach to it.

Magyi (Hoare) island 145 feet (44^m2) high, lies about 3½ miles south-south-eastward of Da That island and about three-quarters of a mile offshore.

Tidal streams.—The tidal stream of the rising tide sets northward 15 along the coast at a rate of about 3 knots at springs and sets southward at the same rate with the falling tide. At springs the water is much discoloured outside the islands.

Charts 1272, 3481.

Anchorage.—Directions.—Anchorage may be obtained, in 20 depths of 6½ fathoms (11^m9), mud, eastward of Wa kyun (*Lat.* 15° 12' N., *Long.* 97° 44' E.), with its northern extremity bearing 299°, and its southern extremity, 215°. Anchorage may also be obtained, in depths of about 7 fathoms (12^m8), eastward of Pascoe shoal, with the eastern extremity of Kokunye kyun in line with the western extremity of the 25 mainland about 3¾ miles south-south-eastward of it, bearing 339°, and Kyettaik kyun bearing 212°.

Anchorage may also be obtained eastward of Kyungyi, in depths of from 9 to 10 fathoms (16^m5 to 18^m3), with the northern extremity of that island bearing 328°, distant 9 cables.

30 Vessels approaching from northward and intending to anchor eastward of Wa kyun, should keep the northern summit of that island bearing 147°, which leads about 1½ miles south-westward of Kokunye kyun and about 11 cables south-westward of Toby rock. When Pagoda point, which from north-westward appears as a hummock at 35 the end of a level stretch of beach, is identified, it should be brought and kept in line with the western slope of Sidaw taung and a dip in the distant high land, bearing 129°, *see* view facing page 416, which leads about 1½ cables northward of the shoal extending northward of Wa kyun ; when the eastern extremity of Nat kyun opens eastward of 40 Wa kyun, bearing about 190°, course may be shaped south-south-eastward for the anchorage.

If intending to anchor eastward of Pascoe shoal, the directions given above should be followed until on the leading line with Pagoda point in line with the western slope of Sidaw taung, when these marks should 45 be kept in line until the eastern extremity of Kokunye kyun comes in line with the western extremity of the mainland, bearing 339°, when course should be altered south-south-eastward and these marks kept in line astern, which leads to the anchorage.

Charts 1272, 3624.

50 Vessels approaching Ye river from southward and having passed southward of Ross sand, should keep Kyungyi bearing 000° until Da That island bears 045°, when course should be shaped to pass midway between Kyungyi and the mainland ; when Pagoda point bears 004° and is in line with a notched peak about 2½ miles northward of it,

Charts 3481, 823, 830, 70.

Charts 1272, 3624.

it should be steered for on that bearing, which leads eastward of Simpson shoal to a position off the entrance of Ye river and eastward of Pascoe shoal.

Chart 1272.

5

YE RIVER.—**General remarks.**—Ye river which enters the sea between Pagoda point and the western extremity of Sidaw taung, is reported to have its source in Thailand beyond the Burmese frontier. After passing through the hills eastward of Ye district, it flows through cultivated land, past Ye town, whence it follows a very tortuous course 10 to the sea. About midway between Ye town and the sea, the river divides into two branches, which join again near its mouth, forming Sonma kyun (Chauma gyun). The north-western branch, when examined in 1887, was quite shallow; the south-eastern branch, of which the lower portion is named Zibyuthaung (Zibuthang) reach, is the 15 navigable channel.

The bar nearly dries. At neaps, the river is only navigable by short vessels with local knowledge with a draught of less than 7 feet (2^m1); at springs, vessels of 13 feet (4^m0) draught might reach the town.

Tides.—**Tidal streams.**—At low water, springs, the water inside 20 the bar is impounded at a level above that outside.

Over the bar, and inside the river, the first of the in-going stream sets in the line of the channels, but when the sands are covered, it sets towards Zibyuthaung point on the northern side, nearly 1½ miles eastward of Pagoda point. The out-going stream sets similarly in a 25 contrary direction, and tends to set a vessel coming down the last reach on to the sands southward of Zibyuthaung point; it is very strong in the channels after the sands dry, and runs at a rate of 4 knots off Sidaw point, the northern point of Sidaw taung.

In the upper reaches the streams follow the direction of the channels, 30 eddies being met with on the down-stream side of the bends. At Ye (Lat. 15° 15' N., Long. 97° 51' E.) the in-going stream runs for about 5 hours.

Beacons.—Outer beacon is a pole surmounted by a diamond, painted white, situated near the fishing stakes about 6 cables north- 35 eastward of Sidaw point.

South Inner beacon is a white globe in a tree at the edge of the mangroves, situated about 6½ cables north-eastward of Outer beacon.

North Inner beacon is a red triangle and diamond in a tree, situated close northward of South Inner beacon. 40

A pole surmounted by a white ball stands on an off-lying rock off the bluff western extremity of Sidaw taung.

A white ball in a tree is situated about one cable east-north-eastward of the pole beacon, on the northern end of the bluff.

A white ball in a tree is situated at the mouth of Awgyi (Oagi) chaung, 45 on the north-western side of Ye river, about 8½ cables northward of Sidaw point.

Directions.—The following directions were those used in 1887. Vessels should cross the bar at high water, both on account of the increased depth over the bar and to avoid carrying up the river a 50 strong in-going stream, with which they might be unable to round the sharp bends and avoid the numerous sands.

Vessels should cross the outer end of the bar with Outer beacon in

Charts 3481, 823, 830, 70.

Chart 1272.

line with South Inner beacon, bearing 051° ; when Pagoda point bears about 324° , the two beacons on the western extremity of Sidaw taung will be in line, bearing 071° ; they should then steer for these beacons, keeping them in line until Outer beacon comes into line with North Inner beacon, bearing 049° , then keep these beacons in line until the western extremity of Sidaw taung bears 180° , when they should keep a little northward and bring Outer beacon between North and South Inner beacons, which leads in until the next reach of the river opens northward.

When Asin (Asun) pagoda, a prominent mark on the western bank of Asin chaung, $1\frac{1}{2}$ miles northward of Sidaw point, bears 351° and is well open eastward of Zibyuthaung point, the vessel should steer for it on that bearing, passing about half a cable off Zibyuthaung point. The beacon at the mouth of Awgyi chaung in line with Asin hill, about 2 miles north-north-westward, bearing 345° , also leads up to this reach. Above this reach the navigation is intricate.

Ye town.—The town of Ye is situated about 6 miles north-eastward of Pagoda point, and stands on high ground on the northern bank of a sharp bend of the river; its pagodas form good landmarks for a considerable distance. There is a wooden pier at Ye (*Lat. $15^{\circ} 15' N.$, Long. $97^{\circ} 51' E.$*).

There is regular sea communication with other Burmese ports.

Ye is connected by railway with Moulmein.

During February the weather is frequently hazy. In the rainy season, from about the middle of May until about the middle of November, fever is prevalent.

Chart 3624.

DAMATHA TAUNG TO TAVOY POINT.—**Damatha taung to Dolphin's nose.**—**Coast.**—Between Damatha taung (page 410) and White point, about 9 miles southward, the high land gradually approaches the coast and the headlands become larger. Kinbun taung (North peak), 2,540 feet (774^m2) high, lies about 6 miles east-south-eastward of Damatha taung, and Pawdi taung (Krounangye), 2,590 feet (789^m5) high, lies about $1\frac{1}{2}$ miles southward of Kinbun taung, but as there are several other summits in the vicinity, these peaks are not easily identified.

Between White point and Dolphin's nose, about 11 miles south-south-eastward, the coast is bold and rocky; Dolphin's nose, which is the northern entrance point of Heinzē chaung, rises steeply to an elevation of 1,000 feet (304^m8).

Heinzē chaung.—**Dangers.**—Heinzē chaung (Heanzay basin) is formed by three large creeks, which flow into the sea through a funnel-shaped estuary between hills, 1,480 feet (451^m1) high, on the northern, and 810 feet (246^m8) high, on the southern side. Kandaung (Kantaung) promontory, 420 feet (128^m0) high, is the southern entrance point of Heinzē chaung, and lies about $1\frac{1}{2}$ miles southward of Dolphin's nose.

The creeks are navigable by small craft for short distances. The shores of Heinzē chaung are, with the exception of a few rocky points, entirely fringed by mangroves, and are intersected by numerous small creeks. The whole district is sparsely populated.

North sands, with depths of less than 2 fathoms (3^m7), and which

Charts 824, 830, 70.

Chart 3624.

dry in patches, extend about $4\frac{1}{2}$ miles south-south-westward from the coast immediately westward of Dolphin's nose. Position rock, which dries about 14 feet (4^m3), lies near the inner edge of North sands, about half a mile east-south-eastward of Dolphin's nose. 5

South sands, with depths of less than 2 fathoms (3^m7) over them and which dry in patches, extend about $3\frac{1}{2}$ miles south-south-westward from Kandaung promontory.

The entrance to Heinzē chaung is obstructed by a bar, which lies between South sands and the outer part of North sands. The outer part of the bar is fairly level, but, farther in between the sands, there are a number of shoal patches, with, in places, greater depths between them. These shoals divide the entrance into two channels, both of which had, in 1924, a least depth of 13 feet (4^m0). The southern of these two channels, which passes close along South sands, has the lesser distance of shallow water to be traversed; it is only one cable wide in the narrowest part, and the shoals are steep-to, with tide-rips during the strength of the tidal streams. The formation of the rocky entrance favours the supposition that the channels are fairly permanent. 10 15 20

Vessels with a draught of 25 feet (7^m6) can enter Heinzē chaung at high water springs, and those with a draught of 18 feet (5^m5) at high water neaps, but local knowledge is necessary, and vessels should on no account attempt to cross the bar without first thoroughly examining, and buoying, the channel which it is intended to take. 25 The port is usually closed to shipping during the South-west monsoon.

Anchorage.—Anchorage may be obtained outside the entrance, westward of North sands, in a depth of $4\frac{1}{2}$ fathoms (8^m2), with Dolphin's nose bearing between 102° and 080° , distant about 3 miles. 30

Within the entrance, anchorage may be obtained anywhere after passing Kandaung promontory (*Lat. $14^\circ 40' N.$, Long. $97^\circ 53' E.$*), but the depths are more convenient, and the tidal streams are weaker, on the southern side.

There is good anchorage within Heinzē chaung, in a depth of 7 fathoms (12^m8), midway between Fish Trap point, the western entrance point of the southern creek, about $4\frac{1}{2}$ miles north-eastward of Kandaung promontory, and the southern end of Kywē-tho-nyima (Kwéthongyima) promontory, about one mile northward of Fish Trap point. 40

Tidal streams.—The tidal streams in the offing set parallel with the coast, setting northward with the rising tide and southward with the falling tide; at the entrance to the channel they also set parallel with the coast; outside South sands they set across the bar and through the channel parallel with South sands until the sands are covered, when they set slightly across them at an estimated rate of from $1\frac{1}{2}$ to 3 knots. 45

The streams in the approaches turn from $2\frac{1}{2}$ to $3\frac{1}{2}$ hours after high and low water at Mergui (*see* predictions in Admiralty Tide Tables). 50

In the entrance to Heinzē chaung, the out-going stream commences at about one h. 15 m. after low water at Mergui and has a rate of from one to 3 knots. The in-going stream commences at about one h. 30 m. after low water at Mergui and has a rate of from about three-quarters

Chart 3624.

of a knot to $1\frac{3}{4}$ knots. Inside the entrance, the out-going stream commences at about one h. 15 m. after high water at Mergui, and the in-going stream at about 0 h. 45 m. after low water at Mergui.

- 5 The observations, on which these remarks depend, were made during the dry season. During the rainy season the out-going stream will be considerably stronger than the in-going stream, and, at times, may possibly overcome the latter stream altogether.

- Kandaung promontory to Pagoda point.—Coast.—Off-lying dangers.**—From Kandaung promontory, the coast trends south-south-eastward for about 16 miles to the mouth of a creek which connects with Heinzē chaung. Tapir hill, 1,212 feet (369^m4), lies about $5\frac{1}{2}$ miles south-south-eastward of Kandaung promontory and about three-quarters of a mile inland, and Middle hill, 1,683 feet (513^m0) high, lies about $2\frac{1}{2}$ miles farther east-south-eastward; both these hills are densely wooded.

- From Middle hill, a range extends about 7 miles southward and about 4 miles inland of this range is another high range lying approximately parallel with the coast, in the middle of which, about $7\frac{1}{2}$ miles south-eastward of Middle hill, is Yetagun taung (Allen peak), a remarkable peak. Paungchon taung (Nabulé Pankhun), 3,830 feet (1167^m3) high, lies at the southern end of this range about $5\frac{1}{2}$ miles southward of Yetagun taung and has a rounded or flattish summit when seen from westward but, when seen from southward, terminates in a sharp peak. 25 Luce hill, 2,315 feet (705^m6) high and Sieve hill, 2,415 feet (736^m1) high, lie about $1\frac{1}{2}$ and 2 miles, respectively, eastward of the mouth of the creek connected with Heinzē chaung, which runs down the valley between the two ranges.

- From the mouth of the above-mentioned creek, the coast trends 30 south-south-eastward for about 8 miles to Fenton point (*Lat.* $14^\circ 18' N.$, *Long.* $98^\circ 00' E.$), a slight projection in the coast. False A peak, 1,460 feet (445^m0) high, lies about $2\frac{1}{2}$ miles west-south-westward of Paungchon taung and about $1\frac{1}{2}$ miles inland, and A peak, situated about $4\frac{1}{2}$ miles southward of False A peak and close within Fenton 35 point, marks the southern end of the coastal range.

Vessels should not approach the coast for about 10 miles southward of Dolphin's nose within a distance of 7 miles; farther southward, abreast Luce and Sieve hills, a closer approach may be made with safety.

- North ledge is an isolated rock 3 feet (0^m9) high, lying about $9\frac{1}{2}$ miles 40 south-south-westward of Kandaung promontory and about 6 miles offshore. A $3\frac{1}{4}$ -fathom (5^m9) patch lies about a quarter of a mile north-eastward of the rock with foul ground between.

- North patch, which dries 8 feet (2^m4), lies about 3 miles south-westward of North ledge; there is a good channel between them with 45 a least depth in the fairway of 11 fathoms (20^m1).

- Maungmagan bay is entered between Fenton point and Pagoda point, about $13\frac{1}{2}$ miles south-south-eastward; it has a low shore with sandy beaches in its northern part, but farther southward the high land, which attains an elevation of 1,562 feet (476^m1) in Toungbadoung, 50 a peak about $3\frac{1}{2}$ miles east-north-eastward of Pagoda point, approaches to within $1\frac{1}{2}$ miles of the coast.

A bungalow is situated on the coast about $2\frac{1}{2}$ miles north-westward of Toungbadoung, and there are others in the vicinity.

Obstruction.—An obstruction with a depth of 2 fathoms (3^m7)

Charts 824, 830, 70.

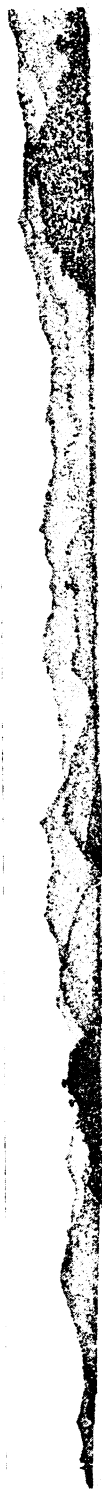
Pawdig
laung.
Kinbun
laung.



Sidaw laung.
Pagoda point, bearing
120°, distant 5½ m.
Wa kyun. Kyetlaik
kyun. Nat kyun.

Entrance to Ye river from north-westward.
(Original dated 1887.)

To face page 417.



N.E. point of Kathemā kyun. ϕ
W. end of Sallak kyun, bearing 173° .

Leading marks for the western channel, Tavoy river.
(Original dated 1886.)

Chart 3624.

over it, exists in a position about $5\frac{1}{2}$ miles north-north-westward of Pagoda point and about $1\frac{1}{2}$ miles offshore.

Chart 824.

Pagoda point to Tavoy point.—Coast.—From Pagoda point, the coast trends southward for about $16\frac{1}{2}$ miles to a point close off which is Pazin kyun (Oyster island), 477 feet (145^m4) high. There are several small islets lying close off this stretch of coast.

Southward of Pagoda point, a mountainous ridge extends parallel with the coast and from about $1\frac{1}{2}$ to 2 miles inland; Letkat taung (Lakhatoung), one of its peaks, 1,966 feet (599^m2) high, stands about 11 miles south-south-westward of Toungbadoung and is surmounted by a pagoda.

From the point abreast Pazin kyun, the coast trends south-south-eastward for about 8 miles to Kyaungdaung-mawgyi, the northern entrance point of Nyaw-byin-aw, and is bold, rocky and indented. Wa-maw (Nyaw-byin point), the southern entrance point of Nyaw-byin-aw, lies about 3 miles south-south-eastward of Kyaungdaung-mawgyi, and the large village of Nyaw-byin stands on the south-eastern shore of the bay.

Between Wa-maw and Thān-maw, the western entrance point of Myinkwa-aw, about $5\frac{1}{2}$ miles southward, the coast continues bold and rocky with no off-lying dangers. Kyan-eik taung, 1,280 feet (390^m1) high, about 3 miles southward of Wa-maw, is covered with forest but shows a slight clearing when seen from westward, and also when viewed from eastward in the estuary of Tavoy river (page 421).

Myinkwa-aw, a bay open southward, is entered between Thān-maw and Tavoy point, about $1\frac{1}{2}$ miles east-south-eastward. Hnget-thaik kyun, an island 523 feet (159^m4) high, about 6 cables southward of Thān-maw, is steep to except on its eastern side, where depths of less than 5 fathoms (9^m1) extend about 3 cables eastward from the island. The channel between Hnget-thaik kyun and the mainland is deep and clear of dangers; it may be used by power vessels but the tidal streams in it have a rate of 3 knots at springs.

Tavoy point (*Lat.* $13^{\circ} 32' N.$, *Long.* $98^{\circ} 10' E.$) which is steep to and on which there is a pagoda, is the southern extremity of a promontory which forms the western side of the estuary of Tavoy river.

Charts 3624, 824.

MOSCOS ISLANDS.—General remarks.—Moscós islands, which are uninhabited, consist of three groups, namely:—Heinzē or North Moscos islands; Maungmagan or Middle Moscos islands; and Launglon Bok or South Moscos islands. They extend in a chain, parallel with the coast, for a distance of 41 miles from North island, the northernmost of the chain, which lies about $11\frac{1}{2}$ miles south-westward of Tapir hill. The islands are mostly steep to on their western side.

Chart 3624.

The highest islands are North island, in the Maungmagan group, which has an elevation of 1,210 feet (368^m8), and Auk Bok (South island), in the Launglon Bok group, which is 1,186 feet (361^m5) high.

Heinzē islands.—North island, the northernmost of the Heinzē group, is 455 feet (138^m7) high; some rocks, 28 feet (8^m5) high, lie half a mile north-north-eastward of North island.

East ledge, which dries 15 feet (4^m6), lies about $1\frac{1}{2}$ miles eastward of North island.

Charts 830, 70.

Chart 3624.

Heinzē Bok (Long island) lies about 2 miles southward of North island, with two islands and some above-water rocks between. Reef islet lies $1\frac{1}{2}$ miles eastward of the southern point of Heinzē Bok ; a rock, with a depth of less than 6 feet (1^m8), lies close southward of Reef islet (*Lat.* $14^{\circ} 24' N.$, *Long.* $97^{\circ} 48' E.$).

Bok Ye-gan (Quoin island), the southernmost island of the Heinzē group, lies about $6\frac{1}{2}$ miles southward of Heinzē Bok ; two islets lie within a mile of the north-eastern side of the island, and four islets lie between the island and Bok Ye-gan.

Maungmagan islands.—Maungmagan islands consist of four densely wooded islands, namely :—Sa-byat-kyun (Neatstongue island), about $3\frac{1}{2}$ miles south-south-westward of Bok Ye-gan ; North island, about one mile farther southward ; Pa-sut-kyun (Baby island), about half a mile south-eastward of the middle of the south-eastern side of North island ; and South island, about three-quarters of a mile south-eastward of the southern end of North island.

Kyauk-bu-taung (Birdsnest rocks), 70 feet (21^m3) high, and Nghet-thalk-taung (Cradle rocks), 365 feet (111^m2) high, lie about 3 miles eastward of North island.

Launglon Bok.—Launglon Bok, separated from Maungmagan islands by Maungmagan passage, in which there are considerable depths, are densely wooded. The three principle islands are Atet Bok (North island), Hngetthaik kyun and Auk Bok (South island).

Atēma kyun (North Button island) lies close eastward of Atet Bok, about $1\frac{1}{2}$ miles from its northern end, and Kama kyun (South Button island) lies close eastward of the middle of Auk Bok.

Chart 824.

Kyaukpyu (Kynakpyu) kyun is a rocky islet, covered with jungle, lying about a mile south-south-eastward of the southern extremity of Auk Bok. South ledge, which dries about 15 feet (4^m6), lies about three-quarters of a mile southward of the southern extremity of Auk Bok. Vessels should not pass between the islet and the ledge.

Chart 3624.

Anchorage.—There is good anchorage in bad weather, eastward of Maungmagan islands, in depths of from 9 to 12 fathoms (16^m5 to 21^m9), between South island and Nghet-thalk-taung ; also eastward of Sa-byat-kyun, in depths of from 9 to 10 fathoms (16^m5 to 18^m3).

Anchorage can also be obtained eastward of Atet Bok in the Launglon Bok group, in depths of from 12 to 14 fathoms (21^m9 to 25^m6), with Atēma kyun bearing 350° .

Moscós channel.—Moscós channel lies between Moscós islands and the mainland eastward of them ; there are considerable depths in the fairway, except at the northern end, eastward of North ledge and North patch (page 416), where the depths are less than 10 fathoms (18^m3).

Vessels proceeding through Moscós channel by day should pass eastward of North ledge (*Lat.* $14^{\circ} 31' N.$, *Long.* $97^{\circ} 49' E.$).

Charts 824, 830, 70.

CHAPTER X

COASTS OF BURMA AND THAILAND—TAVOY POINT TO KŌ PHUKET,
INCLUDING MERGUI ARCHIPELAGO.

Chart 830.

TAVOY RIVER.—**General remarks.**—Tavoy river is about 120 miles in length and has its main source in the western slopes of the range which separates Burma from Thailand.

The river flows through the town of Tavoy, which stands on the left bank about 33 miles northward of Tavoy point (page 417); about 3 miles above the town it traverses a broad plain and its course is impeded by sandbanks and alluvial islands, which are constantly changing in form and position, and which obstruct the river until the estuary is reached. 5 10

Chart 924.

Many tidal creeks intersect the plain between the river and the foot of the hills on either side of it.

There are moderate depths in the entrance eastward of Tavoy point, the western entrance point of the river, and there are depths of not less than 4 fathoms (7^m3) in the fairway of the entrance channel for about 10 miles above the entrance, except for a small area about one mile north-eastward of Mibya kyun (page 420), situated about 5 miles north-north-eastward of Tavoy point, where there is a least charted depth of 22 feet (6^m7). 15 20

Aspect.—On the western side of the estuary, the hills generally run north and south in parallel ranges, rising steeply to an elevation of 1,131 feet (344^m7) in Shinmaw-daung, about three-quarters of a mile northward of Tavoy point (*Lat.* 13° 32' N., *Long.* 98° 10' E.); farther northward, they recede gradually from the western bank of the river, and abreast Goodridge plains, situated about 16½ miles northward of Tavoy point, the crest of the range, which is about 2,000 feet (609^m6) high, lies about 2½ miles from the western bank; abreast the town of Tavoy, the range again closely approaches the river bank. 25

On the eastern side of the estuary, there are low hills with parallel ridges behind them, gradually rising to an elevation of 3,690 feet (1,124^m7) at Nanpayok taung (Natyadoung), the highest peak of a range of the same name, situated about 19 miles eastward of Tavoy point; Buktaung, a steep summit, 2,195 feet (669^m0) high, rising from a low range near the coast about 5 miles westward of Nanpayok taung, is conspicuous, as is also Tetchaung taung, situated about 9½ miles westward of Buktaung and similar in appearance to that hill. 30 35

Charts 824, 830, 70.

Chart 924.

At Elbow point, situated on the eastern bank of the river about 9½ miles westward of Tetchaung taung, the river narrows considerably ; between this point and Shwetaung, a hill, 800 feet (243^m8) high about 5 7 miles north-north eastward, the hills approach the eastern bank and at Shwetaung are within about 1½ miles of it ; they maintain this distance as far as the town of Tavoy where they again recede from the bank and rise in successive ranges to the conspicuous Nwalabo taung, 5,063 feet (1,543^m2) high and the highest peak in the range of 10 the same name, which is situated about 14 miles east-south-eastward of the town. See view on chart 924.

Estuary of Tavoy river.—Islands and dangers.—Lights.—

The estuary of Tavoy river is about 12 miles wide at its entrance between Tavoy point and the coast about 7 miles westward of Nanpayok 15 taung, whence the eastern bank of the river trends towards the western bank in a north-westerly direction for about 12½ miles to Elbow point, abreast which the river is about 3 miles wide. Above Elbow point, both banks of the river trend in a general northerly direction for about 21 miles to the town of Tavoy.

20 The land on the eastern side of the estuary is flat and open with clumps of trees and paddy cultivation, and with several small hills from about 250 to 1,000 feet (76^m2 to 304^m8) high in places. The higher ranges, behind the coastal hills, are described above.

Nauwi rocks, 4 feet (1^m2) high, lie about 4½ miles south-westward of 25 Buktaung and about 2½ miles offshore. About 1½ miles south-south-eastward of Nauwi rocks, and a similar distance offshore, are some rocks which dry about 15 feet (4^m6). A rock, which is awash at high water, lies about one mile south-south-westward of Nauwi rocks.

Taungbyauk chaung, Pyinbyu chaung and Laba chaung are three 30 small rivers which enter the north-eastern side of the estuary at about 4, 3 and 2 miles, respectively, east-south-eastward of Elbow point.

Rocky and dangerous ground with drying sand and mudflats fringes the north-eastern side of the estuary between the eastern entrance point and Elbow point (*Lat.* 13° 43' N., *Long.* 98° 14' E.).

35 Off the mouths of the above-mentioned small rivers, the mudflats extend as much as 2½ miles offshore. An extensive shore bank, on which the depths are less than 3 fathoms (5^m5), fronts the whole of this stretch of coast and extends as much as 7 miles offshore in a position about 6½ miles west-north-westward of Nauwi rocks. A 40 12-foot (3^m7) patch lies close off the south-western extremity of this shore bank and on the eastern side of the entrance channel of the river.

The western side of the estuary trends in a general northerly direction for about 11 miles between Tavoy point and a point about 3 miles westward of Elbow point, the southern part of this stretch of coast 45 being fronted by several islands of which Mibya kyun, the outermost island, lies about 4½ miles north-north-eastward of Tavoy point. The main entrance channel of Tavoy river passes close eastward of these islands and thence close to the western bank of the river.

A light is exhibited, at an elevation of 309 feet (94^m2), from a white, 50 square masonry tower, 31 feet (9^m4) in height, situated on the northern summit of Mibya kyun, about 5 miles north-north-eastward of Tavoy point. Clearings of trees have been made in places to render the light visible and were formerly conspicuous, but in 1945 it was reported that the trees had grown considerably. Clearings of the trees which

Chart 924.

cover Kyan eik-taung (page 417), situated about 4 miles west-south-westward of the lighthouse, may also be seen from a position eastward of that mountain.

Puklaji, a rocky head, awash, is situated about 14 cables north-eastward of the summit of Shinmaw-daung. 5

A shoal, on which the depths are less than 3 fathoms (5^m5) and which has a least depth of 4 feet (1^m2), extends about 12 cables southward from a position about 2 cables south-eastward of the south-eastern point of Mibya kyun. 10

Whale rocks, a reef of boulders, 3 feet (0^m9) high, lie about 4 cables south-south-eastward of Mibya kyun lighthouse. Vessels should not approach within a distance of one cable of Whale rocks.

The eastern and western sides of Mibya kyun are comparatively steep-to, but a spit, on which the depths are less than 3 fathoms (5^m5), extends about half a mile south-south-westward from the southern end of the island and rocks which dry 6 feet (1^m8) lie close off the northern end of the island. Boats can land on a beach on the eastern side of Mibya kyun, about 2 cables southward of the lighthouse. 15

Thin-bôn kyun is a thickly wooded island lying about three-quarters of a mile north-westward of Mibya kyun with its north-western side close to the western shore of the estuary. The bight between the south-western side of Thin-bôn kyun and the coast south-south-westward of it is encumbered with Tamokkyi, a shoal which dries from one to 9 feet (0^m3 to 2^m7). Pazin kyun, 187 feet (57^m0) high, lies close to the shore of the bight, about $2\frac{1}{2}$ miles westward of Mibya kyun lighthouse. 20

Satlaik kyun, a granite islet covered with trees the tops of which are 162 feet (49^m4) high, lies about $1\frac{1}{2}$ miles north-north-westward of Mibya kyun lighthouse (*Lat.* $13^\circ 37' N.$, *Long.* $98^\circ 13' E.$) and close off the eastern side of Thin-bôn kyun. A narrow ridge, on which the depths are less than 3 fathoms (5^m5), extends from Satlaik kyun through the passage between Thin-bôn kyun and Mibya kyun for about 3 miles south-south-westward; Kyauk-pôn-gyi, 3 feet (0^m9) high, is situated near the middle of the ridge, about 6 cables westward of Mibya kyun lighthouse. 35

Kathêmā kyun, another densely-wooded island, is situated close offshore about 4 cables northward of Thin-bôn kyun; a large granite boulder, with a pagoda on it, stands on the north-eastern point of the island. 40

Between Kathêmā kyun and the point opposite Elbow point, about 3 miles northward, the western bank of the river has three indentations, each of which is filled with a drying flat.

Northward of Kathêmā kyun, the main entrance channel lies close to the western bank of the river, the eastern side of the channel being formed by a spit of sand and mud which, with depths of less than 2 fathoms (3^m7), extends about $5\frac{1}{2}$ miles southward from Pyin-gyi, see below, and divides the river into two channels. A light is exhibited, at an elevation of 15 feet (4^m6), from a steel pile structure, situated on the western edge of the spit, about $2\frac{1}{2}$ miles northward of the pagoda on Kathêmā kyun. 50

A 14-foot (4^m3) patch lies on the western side of the fairway about three-quarters of a mile northward of the pagoda on Kathêmā kyun; a mooring buoy for the use of lighters is moored about 3 cables southward of this patch. 55

Charts 824, 830, 70.

Chart 924.

Mahratta rock, a pinnacle rock on which there is a depth of 7 feet (2^m1), lies on the western side of the fairway, about 6 cables west-south-westward of the steel pile light-structure. Rocky ground, over which there is a least depth of 12 feet (3^m7), lies in the fairway about 3 cables eastward of Mahratta rock; the depths in this vicinity are irregular and the bottom is hard. A 12-foot (3^m7) patch with a 14-foot (4^m3) patch close south-westward of it, lie in the fairway about three-quarters of a mile north-westward of the steel pile light-structure.

10 **River above Elbow point.—Dangers.**—Elbow point is thickly covered with mangroves and from the point the eastern bank of the river trends northward for about 7½ miles to the village of Sinbyubyin.

Pyin-gyi, an island thickly covered with trees about 30 feet (9^m1) high, lies in mid-river and extends about 7½ miles northward from its southern point which is situated about 2¼ miles north-westward of Elbow point; on the eastern side of the island, about 3 miles from its northern end, is a tree, 50 feet (15^m2) high, which is conspicuous. The main channel passes westward of Pyin-gyi.

Chaukdaw rock, with a depth of 10 feet (3^m0) over it, lies about 20 2¼ miles north-westward of the southern extremity of Pyin-gyi and about 1½ cables from the western bank of the river.

Northward of Pyin-gyi, a succession of similar alluvial islands which are connected by shoals, extends up the river as far as the town of Tavoy.

25 **Anchorage.**—Good sheltered anchorage may be obtained, in depths of about 24 feet (7^m3), northward and well clear of Puklaji and between it and the southern end of the shoal ridge extending southward from Kyauk-pôn-gyi.

Deep draught vessels may obtain anchorage in depths of from 30 30 to 34 feet (9^m1 to 10^m4), about three-quarters of a mile eastward of Mibya kyun lighthouse (*Lat. 13° 37' N., Long. 98° 13' E.*); also in depths of from 31 to 38 feet (9^m4 to 11^m6), about half a mile north-eastward of Satlaik kyun; and in depths of from 32 to 40 feet (9^m8 to 12^m2), about half a mile eastward, or three-quarters of a mile north-35 south-eastward of Kathêmā kyun.

Farther up the river, anchorage may be obtained in depths of about 19 feet (5^m8), about 1½ and 1½ miles south-south-westward of the southern extremity of Pyin-gyi; also off Goodridge plains in depths of 13 feet (4^m0); at the latter anchorage a waterfall bears 270°, distant 40 about 1½ miles.

Anchorage may also be obtained off Sinbyubyin in a depth of 6 feet (1^m8); the anchorage area is about one cable wide and extends northward of a disused light column.

Tidal streams.—During the dry season the tidal streams in the 45 river run at rates of from 3 to 4 knots. During the rains the out-going stream may run all the time with rates of up to 7 knots.

Quarantine.—Vessels suspected of, or infected with, yellow fever, must anchor not less than half a mile seaward of the mouth of Tavoy river; those vessels having other diseases on board must anchor off 50 Sinbyubyin. See quarantine regulations on page 40.

Directions.—In February 1949, vessels entering Tavoy river were directed to follow a swept channel running in a 345° direction, from a position 5½ miles 121° from the pagoda on Tavoy point, which leads towards the anchorages off Mibya kyun, Satlaik kyun and Kathêmā

Chart 924.

kyun, which are indicated on the chart. If proceeding to the anchorage about three-quarters of a mile north-north-eastward of Kathēmā kyun, from a position about half a mile eastward of Mibya kyun lighthouse, course should be shaped about 350°, which leads to the anchorage. 5
If proceeding to the anchorages higher up-river, when northward of the 14-foot (4^m3) shoal situated about three-quarters of a mile northward of Kathēmā kyun, course should be altered westward to bring the north-eastern point of Kathēmā kyun in line astern with the western edge of Satlaik kyun, bearing 173°. This stern mark leads in the fairway to 10
the anchorage south-south-westward of the southern end of Pyin-gyi, passing between Mahratta rock and the 12-foot (3^m7) shoal which lies about 3 cables eastward of it, but it leads very close eastward of the 12-foot (3^m7) patch situated about three-quarters of a mile northward of Mahratta rock. See view facing page 417. Beyond 15
these anchorages, vessels should employ a pilot.

The above-mentioned stern leading mark leads eastward of Chaukdaw rock, and vessels proceeding to the anchorage off Goodridge plains should keep on this leading mark until that rock is passed, which is indicated by a prominent fall, situated on the southern side of Shwe- 20
yin-e taung, about 3½ miles west-north-westward of the southern end of Pyin-gyi, bearing less than 248°. The western bank of the river should then be closed and kept at a distance of about 1½ cables until the anchorage off Goodridge plains is reached.

Small craft with local knowledge can normally proceed to Sinbyubyin 25
at high water springs. At neaps, during the height of the rains, the flood stream is not felt above the northern end of Pyin-gyi.

Above Sinbyubyin, shoals are numerous and the channels are continually changing. Short and handy vessels of a draught of not more than 8 feet (2^m4) can proceed to Tavoy town, but a pilot should be 30
employed above Elbow point.

Tavoy town.—Port facilities.—The town of Tavoy (*Lat.* 14° 04' N., *Long.* 98° 11' E.) is the headquarters of the district of the same name; it is situated on the eastern bank of Tavoy river. The public buildings are situated in the centre of the town with the residences of Govern- 35
ment officials northward of them and the business sections westward, along the water front. In 1931, the population was 29,018.

Small quantities of liquid fuel are normally maintained. Fresh meat and bread are generally obtainable but vegetables are 40
scarce.

Limited supplies of fresh water may be obtained.

Minor repairs to small craft can normally be undertaken. There is a jetty equipped with a crane of 10 tons lifting capacity and there is a passenger pontoon and several wooden jetties along the water 45
front of the town.

There is regular sea communication with Rangoon.

The nearest railway is at Ye, about 75 miles northward; a road connects Ye and Tavoy.

There is normally a moderately large trade with Rangoon, Penang and ports in Thailand. The principal exports are rice, silk, salt, 50
wolfram, tin ore, rubber and salted fish; and the chief imports are raw silk, piece goods and mining machinery. Silk weaving and mining are the principal industries.

Storm and weather signals.—The general system, see pages 30,

Charts 824, 830, 70.

Chart 924.

to 32, is in use at Tavoy. The port receives information but displays no signals.

Winds.—See percentage frequency of wind direction on page 90.

*5 Chart 824.***TAVOY RIVER ENTRANCE TO ROUND HILL.—Coast.—**

Off-lying rocks.—From the eastern entrance point of Tavoy river, the coast trends in a general south-south-easterly direction for about 66 miles to Kalwin point, the north-western extremity of Mergui island.

- 10 The best landmarks on the northern part of this stretch of coast are Shittaunggyi, a peak 1,500 feet (457^m2) high, standing on the coast about 16 miles east-south-eastward of Tavoy point, and Round hill, 650 feet (198^m1) high, also standing on the coast about 10 miles south-south-eastward of Shittaunggyi.

- 15 Kantu rocks, two isolated rocks, 10 and 8 feet (3^m0 and 2^m4) high, respectively, with depths of less than 5 fathoms (9^m1) extending about half a mile southward of them, lie about 5½ miles west-north-westward of Round hill, the outer rock being about 4 miles offshore.

- The coast between Round hill and Kalwin point forms the eastern side of the Inner route to Mergui harbour, see page 425.

- Mountain ranges with distinctive peaks back the coast for about 40 miles south-south-eastward of the entrance to Tavoy river; the southernmost peak of the highest range is Chimun taung (*Lat.* 13° 24' N., *Long.* 98° 48' E.) (chart 830), 5,304 feet (1,616^m7) high, about 20 miles north-eastward of Round hill. Besides Shittaunggyi and Round hill, the following make good marks useful for navigation :—Seinnat taung (South hill), about 6 miles south-south-eastward of Round hill; Zotzit hill, close within Zotzit point, situated about 5 miles south-south-eastward of Seinnat taung; Flat hill, about 7¼ miles south-south-eastward of Zotzit hill; and Barn hill, 1,038 feet (316^m4) high, about 6½ miles farther in the same direction.

Charts 216a, 3051 and 3052.

- MERGUI ARCHIPELAGO.**—Mergui archipelago extends from Tavoy island, the northern extremity of which is nearly 20 miles southward of Tavoy point, to Similan islands, a distance of about 285 miles; Great Western Torres islands, the outermost islands, lie about 70 miles off the mainland; there are many small barren rocks in the archipelago, usually with considerable depths near them. The bank of soundings extends for some distance outside most of the islands, but it has not been examined. The islands are also described on page 19.

Routes.—The navigation amongst the islands between Tavoy and Pakchan river, a distance of about 210 miles, is almost completely sheltered for power vessels and small sailing craft.

- 45 The best route for power vessels is westward of Domel island, the northern point of which lies about 45 miles south-south-westward of Kalwin point, and Bushby island, about 2 miles south-westward of Domel island, thence through Forrest strait (page 460), and eastward of Hastings and St. Matthew's islands (page 467). Small vessels pass eastward of Domel island and Sir E. Owen island, about 10 miles southward, but the passage near the northern part of Domel island dries almost across, leaving a narrow channel through sandbanks, named Celerity passage.

Charts 830, 70.

Charts 216a, 3051 and 3052.

Caution.—In passing through any of the channels, or inside the islands, in addition to sounding, a good lookout is imperative, as probably more reefs exist than are indicated on the chart.

The channels between the outer islands are so imperfectly known 5 that none of the entrance channels from seaward, which lie between Metcalfe (Sir Charles Metcalfe) island (page 429) and Kō Sindarar, except Nearchus passage (page 443), Forrest passage (page 459), and Investigator channel (page 467), should be attempted.

Chart 824.

10

NORTHERN APPROACH TO MERGUI.—Approach routes.

—From northward, Mergui may be approached by the Inner route, which lies between Tavoy island and the coast of the mainland; through Middle passage, which lies between South rocks, situated about 3 miles southward of Tavoy island, and the northern end of 15 Iron island (Thamihlagyun), about $2\frac{1}{2}$ miles southward; or through Iron passage, which lies between the southern end of Iron island and the northern end of King island, about $1\frac{1}{2}$ miles southward. Power vessels from northern ports use the Inner route.

Western side of Inner route.—Tavoy island.—Anchorage.— 20

Obstruction.—Tavoy island, the northern extremity of which lies about 20 miles south-south-eastward of Tavoy point, is a narrow, mountainous island lying parallel with the mainland coast and about 19 miles in length. Its western side is very steep and rises to an elevation of 2,254 feet (687^m0) at Singaung taung, about 7 miles 25 southward of its northern extremity. A small white pagoda, which is not visible from northward, stands on the eastern coast of the island, about 2 miles from its southern end. Although the island is considered to be fertile, there is little cultivation but rice and vegetables are grown.

South island (*Lat.* 12° 54' N., *Long.* 98° 18' E.), 540 feet (164^m6) 30 high and densely wooded, lies close southward of Tavoy island, separated from it by a passage $1\frac{1}{2}$ cables wide, which is not navigable. South rocks, a chain of rocky islets, lie between half a mile and $2\frac{1}{2}$ miles southward of South island.

Edward, William, Rich and Campbell islands, a group connected 35 by a shallow drying flat, lie between half a mile and one mile off the eastern coast of Tavoy island about 6 miles southward of its northern end; North Button, Rat and Mouse islands lie within about half a mile of the northern side of the group.

The passage between the group of islands and the eastern side of 40 Tavoy island is known as Port Owen and affords anchorage, sheltered from eastward, in depths of from 7 to 13 fathoms (12^m8 to 23^m8). There is a least depth of 6 fathoms (11^m0) in the northern approach to the anchorage, but in the southern approach, a spit, with depths of less than 5 fathoms (9^m1) over it, extends southward from Campbell island, 45 the south-easternmost island of the group, to within half a mile of the coast of Tavoy island. An obstruction, over which there is a depth of 4 fathoms (7^m3), lies close westward of the spit, about three-quarters of a mile south-westward of the south-eastern extremity of Campbell island.

50

During the South-west monsoon sudden squalls of great violence are liable to sweep down from the mountains and caution is necessary as the holding ground at the anchorage is not good.

Charts 830, 70.

Chart 824.

There are about four small villages in the vicinity of Port Owen ; in 1946, they were inhabited by about 540 Karens ; some Burmese fishermen occupy the southern part of the island. The principal village, with about 200 inhabitants, lies at the head of Fisher bay (Lat. $13^{\circ} 05' N.$, Long. $98^{\circ} 18' E.$), on the southern side of the southern entrance to Port Owen. Good landing is possible for boats in Fisher bay, elsewhere the coast is rocky and landing is dangerous especially at low water.

- 10 Round, Cochin and South Button islands lie from half a mile to $1\frac{1}{2}$ miles off the eastern side of Tavoy island, about 8, 6 and 3 miles, respectively, from the southern extremity of the island.

Tidal streams.—During the rising tide the stream sets southward through Port Owen with rates of from one to 2 knots at springs in the dry season, but may reach 4 knots during the rains. During the falling tide the stream sets northward with rates of from 2 to 3 knots at springs in the dry season. During the rains, the rates are weaker and at neaps, the set may be southerly. During the South-west monsoon, the effect of the tidal stream across the wind is liable to make the anchorage uncomfortable.

- Off-lying islands and rocks.**—Pinnacle rock, 150 feet (45^m7), West rock, 110 feet (33^m5), and Mali Kaing (North rocks), 340 feet (103^m6) high, respectively, are a group of steep-to black rocks lying about 3 miles westward of the southern part of Tavoy island. Great Canister island, 1,084 feet (330^m4) high, densely wooded and steep-to on its western side, lies about $6\frac{1}{2}$ miles westward of the southern end of Tavoy island. Mali Don and Birds Nest islands (Grey rocks) consist of three grey rocks lying about 3 miles westward of South island. Little Canister island (chart 1075), about 5 miles southward of the southern end of Great Canister island, is 1,000 feet (304^m8) high, conical and densely wooded.

The channels between Great and Little Canister islands and between these two islands on the west and Mali Kaing and Birds Nest islands on the east are both free from dangers.

- 35 The description of the western side of Inner route is continued on page 428.

Eastern side of Inner route.—Islands and dangers.—Between Round hill (page 424) and Zotzit point, situated on the northern side of the entrance to Palauk chaung, about $10\frac{1}{2}$ miles south-south-eastward, the coast is fronted by extensive flats of sand and mud which, with depths of less than 5 fathoms (9^m1) over them, extend as much as $9\frac{1}{2}$ miles offshore. Zotzit flat, which dries in patches, is a large flat of sand and mud which extends about 7 miles westward of Zotzit point.

- There is a least depth of $5\frac{1}{2}$ fathoms (10^m1) over a width of about $2\frac{3}{4}$ miles in the fairway of the navigable channel between the extensive flat extending westward from this section of the mainland and the northern part of Tavoy island ; anchorage may be obtained in this channel. The tidal streams set through this channel at a rate of $1\frac{1}{2}$ knots at springs ; the stream on the rising tide sets towards the flat which extends westward from the mainland ; soundings give warning of approach to this flat.

Kyunhla taung is a conical island, 542 feet (165^m2) high, lying about $6\frac{3}{4}$ miles south-westward of Zotzit point. Kumla patch, over which there is a depth of $3\frac{1}{4}$ fathoms (5^m9), lies about $3\frac{1}{4}$ miles south-

Chart 824.

south-westward of Kyunhla taung. Mandrell reef, 5 feet (1^m5) high, is an isolated reef lying about 5½ miles south-eastward of Kyunhla taung and about 4 miles westward of the entrance to Palan chaung.

Anyinpo and Anyinma islands, situated about 11 and 12½ miles, respectively, southward of Zotzit point, are densely wooded; shoals and reefs extend between the coast of the mainland and these islands.

Bowers reef, about 1½ miles south-westward of Anyinma island, dries 6 feet (1^m8); there are depths of 5½ and 4½ fathoms (10^m1 and 8^m2) close westward and south-eastward, respectively, of the reef. Galbraith rock (*Lat.* 12° 50' N., *Long.* 98° 34' E.), about 4 miles southward of Anyinma island, dries 9 feet (2^m7) and has depths of 8 or 9 feet (2^m4 or 2^m7) around it.

Gladys island, about 2½ miles east-south-eastward of Galbraith rock, and about 1½ miles offshore, lies on the eastern edge of a drying mudbank and is the northernmost of a group of islands which are separated from the mainland by narrow creeks and mudbanks, and which, from seaward, appear to be part of it.

Long island (*Lat.* 12° 47' N., *Long.* 98° 31' E.), 440 feet (134^m1) high, lies about 6½ miles south-south-westward of Anyinma island and is the north-easternmost and outer of a group of small islands which lie off the coast of the mainland in the northern approach to Mergui harbour. Depths of less than 5 fathoms (9^m1) extend about one mile westward from Long island, and from its eastern side a flat of mud and sand, on which there are depths of from 2 to 4 feet (0^m6 to 1^m2), extends about 6 cables eastward. Daisy rocks, 22 feet (6^m7) high, lie about one mile eastward of Long island, and Cone island, a conical islet, 127 feet (38^m7) high, lies about 7 cables east-south-eastward of the southern end of Long island. Two Spade island lies about 3 miles east-south-eastward of Cone island.

Chart 1075.

Kadwe rock, 4 feet (1^m2) high, lies about 2½ miles southward of Long island. Kyaukkayan islands consist of a chain of rocks lying about 2½ miles eastward of Kadwe rock; the four northern rocks are connected at low water and the highest, which has an elevation of 87 feet (26^m5), has patches of scrub on it. A rock, awash, lies about 2 cables southward of the southernmost rock of the group.

Kyaukmē island, 14 feet (4^m3) high, lies about 1½ miles southward of the southernmost Kyaukkayan rock; a rock which dries 8 feet (2^m4) and another which dries 10 feet (3^m0), lie about half a mile south-westward, and one mile south-south-eastward, respectively, of Kyaukmē island.

Sabahlaing island, 37 feet (11^m3) high, lies about 3½ miles south-eastward of Kyaukmē island; Cap rock, 22 feet (6^m7) high, lies about 4½ miles south-south-westward of the same island; and Thityagyun island, a precipitous square rock, 86 feet (26^m2) high, lies about 1½ miles south-eastward of Cap rock. These three islets or rocks stand on an extensive bank on which the depths are less than 3 fathoms (5^m5), the western side of which extends from a position about 2½ miles north-westward of Cap rock, almost to Kalwin point, a distance of about 11 miles south-south-eastward and at the entrance to Mergui harbour.

For a description of the approach to Mergui harbour south-south-eastward of Cap rock, *see* page 432.

Charts 824, 830, 70.

Chart 1075.

Western side of Inner route (*continued from page 426*).—**Islands and dangers.**—**Anchorage.**—Iron island (Thamihlagyun) is situated about $2\frac{1}{2}$ miles south-south-eastward of the southern end of South rocks and about $1\frac{3}{4}$ miles northward of the northern end of King island ; it is separated from South rocks by Middle passage and from King island by Iron passage. These passages are described on page 432.

Iron island is narrow and about $4\frac{3}{4}$ miles in length ; it attains an elevation of 1,202 feet (366^m4) near its southern end and is precipitous and steep-to on its western side. Good anchorage may be obtained off the eastern side of the island.

King island, the north-eastern side of which forms the western side of the Inner route, is a large island with a scanty population and is rich in fine forest trees.

Lys shoal, lying about 5 miles south-eastward of the southern end of Iron island and about one mile off the north-eastern coast of King island, consists of two rocky patches. There is a least depth of $1\frac{3}{4}$ fathoms (3^m2) over the north-western patch and of 2 fathoms (3^m7) over the south-eastern patch. The south-western extremity of Iron island, bearing 308° and in line with the south-western extremity of Little Canister island, leads close north-eastward of Lys shoal.

Padaw-aw, a bight in the north-eastern coast of King island, is entered between a point about one mile south-south-westward of Lys shoal and the northern extremity of Plantain island, about $2\frac{1}{2}$ miles east-south-eastward. Daungnet taung, 1,361 feet (414^m8) high, stands about 6 cables within the northern extremity of Plantain island ; Kyunsin-yē, an islet, 10 feet (3^m0) high, lies about 4 cables north-westward of the northern extremity of Plantain island.

Except near its entrance, Padaw-Aw is almost entirely filled by drying flats which extend from each side of the bight ; Tein chaung, a shallow channel running between these flats, is known to extend for about 2 miles southward and was formerly supposed to communicate with Fell passage (page 438), on the eastern side of King island.

Anchorage may be obtained in a depth of about 7 fathoms (12^m8), with the western entrance point of the bight bearing 341°, distant about half a mile, but this anchorage is only about $1\frac{1}{2}$ cables from the edge of a 2-fathom (3^m7) patch. Vessels of shallow draught can anchor about $8\frac{1}{2}$ cables south-westward of the above anchorage berth, off the watering-place, where there is a stony beach and a rocky islet.

In the perigee spring tides of February or March, the tide may fall one foot lower than the datum to which the soundings on the charts are reduced.

For the description of the approach to Mergui harbour south-south-eastward of Plantain island, *see* page 432.

45 *Charts 824, 216a.*

WESTERN APPROACH TO MERGUI.—**Islands and dangers.**

—**Passages.**—**Anchorage.**—Cabusa (Kabosa) island, the northernmost outer island of Mergui archipelago, lies about 26 miles west-south-westward of the southern end of Tavoy island ; it has four principal peaks arranged in the form of a square, the two southern summits being about 1,300 feet (396^m2) high. The island is densely wooded and, except for a rock about one cable off its south-western extremity, its coasts are steep-to.

Charts 830, 70.

Charts 824, 216a.

Investigator passage lies between Cabusa island on the north and West Canister islet, North and South Pinnacle, and Freak islet on the south. West Canister islet, 472 feet (143^m9) high, steep and covered with jungle, lies about 8 miles south-westward of the south-western point of Cabusa island. North and South Pinnacle, two rocks, 15 and 12 feet (4^m6 and 3^m7) high, stand on an isolated rocky patch about 4½ miles eastward of West Canister island. Freak islet, 120 feet (36^m6) high, conical and with a few straggly trees on it, is situated about 5 miles southward of the south-eastern point of Cabusa island (Lat. 12° 46' N., Long. 97° 53' E.).

Tenasserim island, situated about 10½ miles southward of Cabusa island, has several peaks, the southernmost and highest of which is 1,020 feet (493^m8) high, and which, from a distance, appear like separate islands. Herbert and Howard islands, 1,047 and 670 feet (319^m1 and 204^m2) high, respectively, lie close together off its northern end, the latter being about 1½ miles distant from it. West islet, 350 feet (106^m7) high, lies close off its south-western side and is not easily distinguished as it appears to be part of the main island. Another islet lies close southward of its eastern extremity and is also not easily made out.

Rock islet, 67 feet (20^m4) high, about one mile north-eastward of the eastern extremity of Tenasserim island, appears white when seen from eastward. Tenasserim island and the adjoining islands and islets are all steep-to, densely wooded, and have no off-lying dangers.

During the North-east monsoon, good anchorage, in depths of 9 fathoms (16^m5), may be obtained near the head of an inlet situated near the middle of the north-western side of Tenasserim island.

The outer islands of Mergui archipelago southward of Tenasserim island are generally similar in appearance, being high, steep and generally covered with foliage and dense jungle.

Saurim (Saurin) island, 585 feet (178^m3) high, lies about 3½ miles south-westward of the southern point of Tenasserim island, and Ramsey and Morgan islets, 348 and 175 feet (106^m1 and 53^m3) high, respectively, lie about 2½ miles east-south-eastward, and 4½ miles eastward, respectively, of Saurim island; a rock, awash, on which the sea breaks in a south-westerly swell, lies about half a mile south-south-westward of Morgan islet. There are considerable depths between these islands and between the group and Tenasserim island, but the currents are irregular and tide rips are experienced.

Blundell island, 934 feet (284^m7) high and surrounded by considerable depths, lies about 4½ miles south-south-westward of Tenasserim island; Chevalier islet, 358 feet (109^m1) high, lies about 1½ miles westward of the southern point of Blundell island and Chevalier rock, an isolated rock, 6 feet (1^m8) high, lies about 4 cables southward of the islet.

Chart 216a.

Lion rock, 130 feet (39^m6) high, lies about 1½ miles southward of Blundell island. Metcalfe (Sir Charles Metcalfe) island, about 1,350 feet (411^m5) high, lies about 6 miles southward of Lion rock.

The islands and passages southward of Metcalfe island are described with the western approach to Bentinck route on page 441.

Mermaid passage, in which there are considerable depths, is entered from south-westward between Lion rock and Metcalfe island. Smart island, about 880 feet (268^m2) high, with rocky coasts, lies about 3 miles

Charts 830, 70.

Chart 1075.

eastward of Metcalfe island ; the northern and southern sides of Smart island are indented but there are many off-lying rocks off the points of the bays and the latter appear to be foul.

- 5 Saddle island, 255 feet (77^m7) high, lies on the south-eastern side of Mermaid passage, about $5\frac{1}{2}$ miles east-south-eastward of the southern point of Blundell island ; a reef extends about one cable from its south-western point.

Charts 824, 216a.

- 10 Oubliée rock (*Lat.* 12° 26' N., *Long.* 97° 58' E.) is an isolated rock, 53 feet (16^m2) high, lying on the south-eastern side of Mermaid passage, about 8 miles eastward of the southern end of Blundell island ; a rock which dries 12 feet (3^m7) lies about 6 cables eastward of Oubliée rock and both of these rocks are apparently steep-to. South Direction
- 15 island, 311 feet (94^m8) high, and North Direction island, 150 feet (45^m7) high, lie at the northern end of the eastern side of Mermaid passage, about 3 miles north-eastward, and 4 miles north-north-eastward, respectively, of Oubliée rock ; the highest part of North Direction island is at the southern end and there are considerable
- 20 depths between it and South Direction island.

- Elphinstone island is a densely wooded island lying close eastward of Mermaid passage with its north-western extremity about 8 miles east-south-eastward of the southern end of Blundell island. On its western side is a bay which extends about $2\frac{3}{4}$ miles in a north-north-
- 25 easterly direction, terminating close under Elphinstone peak at its northern end ; this mountain, 1,750 feet (533^m4) high, appears as a separate conical island when seen from some distance northward. False peak, 1,415 feet (431^m3) high, situated close within the eastern head of the bay, about $1\frac{1}{2}$ miles south-eastward of Elphinstone peak,
- 30 is also prominent. During the North-east monsoon, anchorage may be obtained near the head of the bay, in a depth of 6 fathoms (11^m0), sand.

- Port Maria and approaches.—Anchorage.**—Port Maria is an inlet in the northern side of Elphinstone island. The western side of the islet is much indented and there are numerous small islets
- 35 close off that side ; the eastern side is steep-to and the hills extend to the water's edge. There is a shallow bay on the eastern side of the head of Port Maria.

- Castle island, 499 feet (152^m1) high, has three peaks and lies on the western side of the northern approach to Port Maria, about three-
- 40 quarters of a mile north-north-westward of the western entrance point. About half a mile south-south-westward of Castle island is Sack island and about 4 cables southward of the latter are two islets. When approaching from northward, these islands all appear to be part of Elphinstone island.

- 45 Entrance islet, 218 feet (66^m4) high, lies in the middle of the northern approach to Port Maria, about 2 miles north-eastward of Castle island. A reef extends about 2 cables eastward and southward from Entrance islet ; the eastern part of the reef just covers at high water. Burne island, 369 feet (112^m5) high, is situated about $1\frac{3}{4}$ miles east-south-
- 50 eastward of Entrance islet, and off its south-eastern point are three small islets, the outermost and smallest being about 4 cables offshore.

Vessels approaching Port Maria can pass on either side of Entrance islet whence course should be shaped directly into the inlet, keeping nearer to the eastern side, until a bay at its western end opens ; when

Charts 824, 216a.

Crab islet, 5 feet (1^m5) high, situated close off the western shore, about 1½ miles southward of the western entrance point, bears 261°, and is in line with Elphinstone peak, good anchorage may be obtained in a depth of 7 fathoms (12^m8); this anchorage is well sheltered except 5 from north-eastward.

The tidal streams in Port Maria are weak. Cross currents are experienced when in the northern approaches to the port and caution should be exercised.

The islands and dangers between Elphinstone island and the southern 10 part of King island, about 12 miles eastward, are described with the north-western approach to Bentinck route on page 440.

Islands and dangers between Elphinstone island and Iron and Middle passages.—Bowers island, 245 feet (74^m7) high and steep, lies about 7 miles eastward of North Direction island. Corbin island, 15 447 feet (136^m2) high, is situated about 2½ miles south-eastward of Bowers island; it is the northernmost of a group of islands and rocks lying eastward of Elphinstone island in the north-western approach to Bentinck route, *see* page 440.

Hayes island lies about one mile eastward of Corbin island with 20 considerable depths between them; both islands are densely wooded.

Page islet (*Lat. 12° 36' N., Long. 98° 10' E.*), lying about 6½ miles northward of the northern point of Corbin island, is a conical rock, 85 feet (25^m9) high, covered with straggly trees; there are considerable depths between it and the Marcus group, about 3 miles north- 25 north-eastward, and also between it and the north-western side of Maingy island, about 5 miles south-eastward.

Charts 1075, 824, 216a.

Marcus group, situated between 5½ and 7½ miles west-south-westward of Kyetmata, the northern point of King island (page 428), 30 consists of Marcus, Gifford, Harris and Genn islands, 460, 440, 480 and 227 feet (140^m2, 134^m1, 146^m3 and 69^m2) high, respectively. A small patch of reef, of which the highest part is 12 feet (3^m7) high, lies about 4 cables south-westward of Gifford island. Harris island appears as two islands, its northern and southern ends being joined 35 only by a narrow strip of sand and scrub. Genn island, the easternmost and smallest of the group, lies about 3 cables eastward of Harris island; there are considerable depths in the channels between the islands but strong currents and tide rips may be expected. There are also considerable depths in the channel between the Marcus group 40 and Kyetmata.

Brown rock, about 2½ miles north-westward of Marcus island, is 66 feet (20^m1) high and has rocks which occasionally dry, close northward and southward of it.

Chart 1075.

Maingy island, situated close off the western side of King island, 45 about 7½ miles south south-westward of Kyetmata, is high and steep on its western side, attaining an elevation of 1,970 feet (600^m4) near its south-western point. It is separated from King island by a narrow channel, impassable even by boats as its southern end is very shallow. 50 The south-eastern side of Maingy island is fringed with mangroves and fronted by an extensive mudbank which dries about 5 feet (1^m5). A small island, 850 feet (259^m1) high, lies close off its north-eastern side and from a distance appears as part of the main island, being

Charts 824, 216a, 830, 70.

Chart 1075.

only separated from it by a narrow strip of mud and mangroves. There is a fishing village on the eastern side of Maingy island.

- Iron and Middle passages.—Tidal streams.**—Iron passage lies
 5 between the northern end of King island and Iron island (page 428), about $1\frac{3}{4}$ miles northward, and leads into the Inner route to Mergui; there are considerable depths in the passage but there are also strong eddies, tide rips and overfalls. Kayindaung, an islet, 53 feet (16^m2) high, with scrub on it, lies about one mile northward of Kyetmata;
 10 Mussel islet, 27 feet (8^m2) high, lies about $3\frac{1}{2}$ cables southward of Kayindaung; and Taungthonlon (Taungthonion), 321 feet (97^m8) high and densely wooded, lies about $3\frac{1}{2}$ cables north-eastward of Kyetmata. South-eastward of Taungthonlon are two other wooded islands close to the shore of a bay at the northern end of King island,
 15 and of which Kyetmata is the western entrance point.

Vessels from westward using Iron passage should keep towards the northern side in order to avoid as much as possible the strong eddies and tide rips off Kayindaung and Mussel islet, but a set towards Iron island must be guarded against.

Charts 1075, 824.

- Middle passage lies between the northern end of Iron island and South rocks (page 425), about $2\frac{1}{2}$ miles northward; it has considerable depths and is free from dangers, but strong tidal streams, eddies and overfalls are experienced, especially during the South-west monsoon.
 25 In both Iron and Middle passages the tidal stream appears to set eastward with the rising tide and westward with the falling tide. In Iron passage, the tidal streams attain a rate of more than 3 knots at springs.

Chart 1075.

- 30 NORTHERN APPROACH TO MERGUI** (*continued from pages 427 and 428*).—**Islands and dangers.**—**Light.**—Between Daungnet taung (page 428) and Cap rock (*Lat.* $12^\circ 38' N.$, *Long.* $98^\circ 33' E.$) (page 427), about $5\frac{1}{2}$ miles east-north-eastward, the channel leading to Mergui harbour is about 3 miles wide, its eastern side being
 35 bounded by the extensive bank which, with depths of less than 3 fathoms (5^m5), extends about 9 miles south-south-eastward to within about three-quarters of a mile of Kalwin point.

- Kalagyun, an island on the western side of the channel, the northern end of which lies about $5\frac{1}{2}$ miles south-south-eastward of Daungnet
 40 taung, is separated from King island by Fell passage, *see* page 438. Kalagyun is fringed by mangroves and there are several hills on its western side. Sagyun, a small island, 322 feet (98^m1) high and steep, lies on the western side of the northern entrance to Fell passage, about $2\frac{1}{2}$ miles north-north-westward of the northern point of Kalag-
 45 yun. Komwē island, 200 feet (61^m0) high and surmounted by a white pagoda, lies near the outer end of a drying flat which extends about $1\frac{1}{2}$ miles northward from the northern point of Kalagyun; a stony shoal with depths of less than 3 fathoms (5^m5), part of which dries, extends about $2\frac{1}{2}$ miles northward from the northern end of
 50 Kalagyun and forms the eastern side of the entrance to Fell passage.

With the exception of a narrow channel which, with depths of from 4 to 15 fathoms (7^m3 to 27^m4), extends about 6 miles southward along the eastern side of Kalagyun to within about $1\frac{1}{2}$ miles of its

Charts 824, 216a, 830, 70.

Chart 1075.

southern point, the whole of the area southward of a line joining Komwē island and Kalwin point, about 6 miles east-south-eastward, is filled with islands, shoals and banks which dry.

Chart 218.

Pataw island lies at the south-eastern corner of this shoal area, about $5\frac{1}{2}$ miles south-eastward of Komwē island and about $1\frac{1}{2}$ miles south-south-westward of Kalwin point. Near the northern end of the island is a peak, 781 feet (238^m0) high; the southern end, named Patit island, contains a hill, 274 feet (83^m5) high, which is surmounted by a pagoda. A white pagoda stands near the eastern coast of Pataw island about 5 cables east-south-eastward of the 781-foot (238^m0) peak and there is a tomb near the south-western point of the island. Oyster pagoda, surmounting a hill, 86 feet (26^m2) high, is situated near the eastern side of Patit island, about $1\frac{1}{2}$ cables northward of the 274-foot (83^m5) hill. Another pagoda stands at an elevation of 190 feet (57^m9), about three-quarters of a cable northward of the southern end of Patit island.

Kalwin point, on which is an obelisk, 6 feet (1^m8) high, is the north-western extremity of Mergui island and the southern entrance point of Kyaukpya river which separates Mergui island from the mainland and is one of the outlets of the Tenasserim river. The entrance channel to Kyaukpya river is only about one cable wide, the northern side of the channel being formed by the extensive bank which forms the eastern side of the northern approach to Mergui harbour.

A light is exhibited, at an elevation of 26 feet (7^m9), from a white steel structure with red bands, situated about 7 cables north-westward of the obelisk on Kalwin point.

MERGUI HARBOUR. — Dangers. — Obstructions. — Mergui harbour lies at the southern end of the channel separating Pataw island from Mergui island. The town of Mergui is situated on the western coast of Mergui island opposite the southern part of Pataw island.

The western coast of Mergui island is low and wooded on its northern part with flats of sand and mud which extend about one cable off-shore and dry from one to 5 feet (0^m3 to 1^m5). About 2 miles southward of Kalwin point obelisk, a sea wall fronts the town, extending about 6 cables south-south-westward with Main wharf at its southern end; Naukle (Crane) jetty extends a short distance from the coast about $3\frac{1}{2}$ cables southward of Main wharf. Mergui pagoda (*Lat.* $12^{\circ} 26' N.$, *Long.* $98^{\circ} 36' E.$), which is gilded and prominent, is situated about 2 cables eastward of Main wharf and overlooks the harbour south-westward of that wharf; it stands at an elevation of 239 feet (72^m9) with various government offices in its vicinity. Behind the town, wooded hills rise to elevations of 100 feet (30^m5) and more, and a conspicuous tree, which when viewed from northward is possibly obscured in places, stands on the north-western slopes of a hill 100 feet (30^m5) high, situated about $6\frac{1}{2}$ cables east-south-eastward of Mergui pagoda.

The entrance channel lies about 2 cables westward of Kalwin point light-structure. It is obstructed by shoal water which, with general depths of 2 fathoms (3^m7) and less, extends about one mile in a south-south-easterly direction from a position about $1\frac{1}{2}$ cables westward of

Charts 1075, 824, 216a, 830, 70.

Chart 218.

the light-structure ; a one-fathom (1^m8) patch lies about 4½ cables south-south-eastward of the light-structure.

An obstruction, with a least depth of 1½ fathoms (2^m7) over it, lies about 2½ cables west-north-westward of the light-structure.

The harbour continues shallow with depths of from 2 to 3 fathoms (3^m7 to 5^m5) in the fairway of the entrance channel, to within about 3 cables northward of Main wharf. Patches with depths of 1½ fathoms (3^m2) exist about 4 and 5½ cables northward of this wharf, and an obstruction, with a depth of 1½ fathoms (2^m3) over it, lies on the western side of the fairway about 9 cables northward of the same wharf.

A shoal area, in which is a group of rocks which dry from 3 to 5 feet (0^m9 to 1^m5), extends about one cable off the eastern coast of Patit island, east-north-eastward of Oyster pagoda, and a detached 2-fathom (3^m7) rocky patch lies on the western side of the southern entrance to Mergui harbour, about 1½ cables eastward of the southern extremity of Patit island.

There are depths of from 3½ to 10 fathoms (6^m9 to 18^m3) at the anchorage westward and south-westward of Main wharf, but this anchorage is much reduced in size by the shoal area extending eastward from Patit island, and by a bank which, with depths of less than 3 fathoms (5^m5), extends about 1½ cables westward of the head of Naukle jetty.

Lights.—Beacons.—A light is exhibited, at an elevation of 20 feet (6^m1), from the head of Main wharf.

A light is exhibited from near the root of Naukle jetty.

A white beacon, 24 feet (7^m3) high, surmounted by a white triangle point down, stands on the western coast of Mergui island, about 8½ cables south-eastward of Kalwin point light-structure.

Leading marks have been established for the entrance channel. The front mark is a white beacon, 45 feet (13^m7) high, surmounted by a white triangle, 35 feet (10^m7) in height, situated on the sea wall, about 3½ cables north-north-eastward of Main wharf ; the rear mark is the spire of Mergui pagoda. These marks in line, bearing 169½°, lead from the northern entrance to the channel for about 2 miles southward in a least charted depth of 2 fathoms (3^m7). The spire of Mergui pagoda (*Lat.* 12° 26' N., *Long.* 98° 36' E.), together with the upper part of the dome immediately beneath it, is brilliantly illuminated at night.

Anchorages.—The outer anchorage lies in the middle of the approach channel north-westward of Kalwin point, between 1½ miles and one mile north-westward of Kalwin point light-structure in depths of from 5½ to 6 fathoms (10^m1 to 11^m0) with the summit of the peak on Pataw island bearing between 170° and 181°.

The best anchorage for vessels of more than 18 feet (5^m5) draught is about 2 cables south-westward of the head of Main wharf. Farther southward, The Pool, a small, deep area off the eastern extremity of Patit island, affords good anchorage for vessels of greater draught, but the tides and eddies are very strong here.

Tidal streams.—The tidal stream sets southward through the harbour with the rising tide and northward with the falling tide. The rate of the tidal streams is about 2 knots at springs during the dry season ; the rate of the ebb-stream is probably greater during the rains.

Charts 1075, 824, 216a, 830, 70.

Charts 824, 1075.

Directions.—Vessels from northward using the Inner route should shape course to pass about 2 miles eastward of the northern extremity of Tavoy island, and thence alter course to pass about the same distance off Cornwall point, the eastern extremity of that island, whence the direct track, which is free from danger, leads between Iron island and Long island. 5

Vessels approaching from westward should proceed through either Middle or Iron passage; care is necessary in both channels on account of strong tidal streams and tide rips. 10

Chart 1075.

Iron island, King island and Plantain island all appear as one lofty island to vessels approaching from northward. From a position about midway between Iron and Long islands, vessels should keep the steep eastern extremity of Plantain island bearing 167° , until Thityagyun 15 bears 113° , when course should be shaped for the summit of Pataw island, bearing 150° . When the north-eastern extremity of Plantain island comes in line with the summit of Little Canister island, bearing about 312° , it should be brought astern and kept on that bearing and a course of 132° made good, which leads to the outer anchorage 20 north-westward of Kalwin point.

Vessels of 10 feet (3^{m0}) draught, and without local knowledge, should not enter Mergui harbour until after the first quarter of the flood tide, and those of greater draught should not enter until after the first half of the flood tide; with local knowledge and at neap 25 tides, vessels of a draught of 15 feet (4^{m6}) may enter after the first quarter of the flood tide.

Chart 218.

Vessels entering Mergui harbour should approach with the beacon situated about $8\frac{1}{2}$ cables south-eastward of Kalwin light-structure, 30 bearing 131° , until the white beacon on the sea wall in front of Mergui, bearing $169\frac{1}{2}^{\circ}$, is in line with Mergui pagoda (*Lat. $12^{\circ} 26' N.$, Long. $98^{\circ} 36' E.$*). These marks should be kept in line until the white pagoda on the eastern side of Pataw island, bears about 258° , when course should be altered slightly eastward for a distance of about $1\frac{1}{2}$ 35 cables to avoid the obstruction about 9 cables northward of Main wharf and a $1\frac{1}{2}$ -fathom (3^{m2}) shoal, about one cable southward of this obstruction. After passing these dangers, a course of about 190° should be maintained.

Mergui town.—Port facilities.—The town of Mergui which, in 40 1941, had an estimated population of about 23,000, is the most important town in the southern province of Burma. It stretches for over one mile along a muddy shore, over a small ridge and down its farther side; its houses are wooden and are mostly roofed with galvanised iron. The town is the centre of rubber and tin mining industries 45 and the pearl fisheries of Mergui island are important. The Port office is situated close to the root of Main wharf and there is a flagstaff about $1\frac{1}{2}$ cables south-eastward of this wharf. The town was damaged during hostilities of 1942-1945.

Main wharf is a wooden structure on steel piles. A floating pontoon 50 is connected to the wharf by a steel cantilever gangway and has a least depth alongside of 10 feet (3^{m0}). Naukle jetty, on which is a steam crane of 3 tons lifting capacity, is reported to have a least depth alongside of 5 feet (1^{m5}). Sea-going vessels normally discharge cargo into lighters. 55

Charts 1075, 824, 216a, 830, 70.

Chart 218.

Small quantities of coal and liquid fuel are normally maintained.

Fresh water is laid on to Main wharf but the supply is limited, especially during the months of April and May. All drinking water should be boiled.

There is a hospital of moderate size situated about half a mile eastward of Main wharf.

The principal exports are rubber, tin, wolfram, timber, mother-of-pearl and shell; the chief imports are cotton piece goods and husked rice.

There is regular sea communication with Rangoon and with other Burmese ports.

Storm and weather signals.—The general system, *see* pages 30 to 32, is in use at Mergui.

Climatic table.—*See* page 86.

Chart 1075.

SOUTHERN APPROACH TO MERGUI.—**Islands and dangers.**—The southern approach to Mergui harbour traverses the islands and mudbanks which extend south-westward from Mergui island, and saves a detour of about 15 miles to shallow-draught vessels with local knowledge coming from southward and using Bentinck route (page 443). The entrance to this approach channel lies between the southern end of Tatagyi, situated about 4 miles south-eastward of the southern extremity of King island, and Kyauknakaungdaung, an islet about $4\frac{1}{2}$ cables farther southward; it is close to the northern end of Bentinck route which passes about 3 miles west-south-westward of it. There are considerable depths in the entrance, and there is a least depth of $3\frac{1}{2}$ fathoms (6^m4) in the fairway of the approach channel as far as an anchorage off Linmalokyun (*Lat.* $12^\circ 19' N.$, *Long.* $98^\circ 28' E.$), about $6\frac{1}{2}$ miles north-eastward of Kyauknakaungdaung; thence, there is a least depth in the fairway of $1\frac{1}{2}$ fathoms (2^m7) as far as the southern of the Ma-aing, two islets close south-eastward of the approach channel, about $2\frac{3}{4}$ miles north-eastward of Linmalokyun, but above this there is a least depth of only one foot (0^m3). Vessels with local knowledge, with a draught not exceeding 8 feet (2^m4), can use this channel at high water.

Tatagyi is a low island with two peaks, the western of which is the higher. Shrub rocks, 23 feet (7^m0) high, lie about $1\frac{1}{2}$ miles west-south-westward of the southern point of Tatagyi, and from them a reef extends about 8 cables north-westward.

Kyauknakaungdaung is 243 feet (74^m1) high and Pindan kyun, about 4 cables southward of it, is 136 feet (41^m4) high; a shoal, with a least depth of $2\frac{3}{4}$ fathoms (5^m0) over it, lies about $1\frac{1}{4}$ miles north-eastward of the former island.

45 Charts 1075, 216a.

Mergui (Merghi) islands are two bold, lofty and densely wooded islands, situated about $1\frac{1}{2}$ miles south-south-eastward, and about $3\frac{3}{4}$ miles southward, respectively, of Pindan kyun. The summit of the southern island, which is the higher, is 1,646 feet (501^m7) high and pyramidal in shape. Shelving mudbanks, on which the depths are less than 3 fathoms (5^m5), extend westward from the northern and southern islands for about $1\frac{1}{2}$ and 2 miles, respectively.

Saunggyi kyun (Garret island) lies about one mile southward of

Charts 216a, 830, 70.

Charts 1075, 216a.

the southern Mergui island; depths of less than 5 fathoms (9^m1) extend about 3½ miles west-south-westward from the western side of Saunggyi kyun.

Chart 1075.

5

The depths between Pindan kyun and the northern Mergui island are apparently irregular; a 3-fathom (5^m5) patch lies about 6 cables east-south-eastward, and a rock which dries 9 feet (2^m7) lies about 14 cables east-north-eastward, of Pindan kyun.

Palok, a small island, lies on the southern end of a drying bank 10 on the south-eastern side of the approach channel, about 2½ miles east-north-eastward of Kyauknakaungdaung.

Between the entrance to the approach channel and the southern Ma-aing, about 9 miles north-eastward, the channel is bounded on the north-west by Tatagyi, Pyinnigyun and Bertie islands which are 15 connected by an extensive drying mudbank, and on the south-eastern side by Palok and the islets, shoals and mudbanks north-eastward of it.

Anchorage.—Good anchorage may be obtained about 3 cables south-eastward of the southern point of Linmalokyun, in a depth 20 of 7 or 8 fathoms (12^m8 or 14^m6).

Chart 216a.

Tidal streams.—Between Pinbwa island, situated about 2 miles north-westward of Shrub rocks, and Christmas island, about 20 miles south-westward, the general set of the tidal stream with the rising 25 tide is south-eastward. In the vicinity of Shrub rocks, the indraught of the stream setting eastward is very strong at springs. See also Tidal streams in Bentinck route, page 451.

Charts 216a, 830.

Mergui harbour to Auckland bay.—Coast.—From the southern 30 entrance to Mergui harbour for about 25 miles southward to the head of Auckland bay, the coast is low and swampy in places; several rivers which are navigable only by boats flow into the sea through narrow channels bounded by flats. The higher ridges or hummocks 35 are generally covered with large trees.

Auckland bay is entered between the northern point of Sellore island, about 3 miles eastward of Saunggyi kyun (*Lat.* 12° 07' N., *Long.* 98° 23' E.), and an island surrounded by mangroves about 10 miles north-eastward. The bay is well sheltered and affords anchorage in depths of from 4 to 12 fathoms (7^m3 to 21^m9), mud, 40 but it has not been examined and caution is necessary.

Tenasserim river has several mouths, the two principal of which are separated by Mergui island. Tonbyaw chaung, the southern-most entrance to this river, joins the main river about 8 miles south-eastward of Mergui harbour. The banks of Tenasserim river are 45 very steep in places and the channel is narrow in parts.

Large boats can ascend Tenasserim river as far as Tenasserim village which lies at the confluence of Great and Little Tenasserim rivers, about 33 miles south-eastward of Mergui harbour. A reef of rocks stretches across the river a few miles below the village and, 50 even during the rains, is impassable by vessels of a draught of more than 6 feet (1^m8).

In 1941, the population of Tenasserim village, which is employed in agriculture, was about 500; the climate here is unhealthy.

Chart 70.

Chart 1075.

- Directions.**—From a position on the Bentinck Route track with the southern point of Yengē kyun (page 444) bearing 316° , distant about $1\frac{1}{4}$ miles, *see* view on chart 1075, vessels using the southern approach route to Mergui should steer about 049° , keeping the southern end of Tatagyi fine on the starboard bow; when about $1\frac{1}{4}$ miles distant from Shrub rocks, course should be shaped to pass midway between the southern end of Tatagyi and Kyauknakaungdaung, allowing for the tidal streams, which are strong at springs.
- 10 After passing the southern end of Tatagyi, course should be shaped to make good 042° , for about $3\frac{1}{4}$ miles; when the eastern extremity of Pyinnigyun bears about 012° , course should be altered eastward to make good about 068° , which leads to the anchorage southward of Linmalokyun. Only vessels with local knowledge should proceed
- 15 north-eastward of this anchorage.

- FELL PASSAGE.—General remarks.—Depths.**—Fell passage, which lies along the eastern coast of King island, is used by vessels proceeding through Mergui archipelago. The passage is about 19 miles in length with a least depth of $3\frac{1}{2}$ fathoms (6^m4) in the fairway at high
- 20 water, neaps; the channel is narrow and runs between mudbanks which extend from the islands but, with a rising tide, it is by no means difficult.

- There are depths of $4\frac{1}{2}$ fathoms (7^m8) in the northern entrance and a least depth of $3\frac{1}{2}$ fathoms (5^m9) can be carried as far as the northern
- 25 extremity of Yemyok, a distance of about 7 miles. Thence, for about 5 miles farther south-south-westward, there is a least depth of $2\frac{1}{2}$ fathoms (4^m1), but a shoal with a least depth of $1\frac{1}{2}$ fathoms (2^m7), which is difficult to avoid, lies about $3\frac{1}{2}$ miles south-south-westward of the northern point of Yemyok and about $1\frac{1}{2}$ cables north-westward of Thanbo (*see* below). In the southern entrance to the
- 30 passage and for about $5\frac{1}{2}$ miles north-eastward of it, there are considerable depths.

- Islands and dangers.—Beacon.**—The northern entrance to Fell passage lies between Sagyun (*Lat.* $12^{\circ} 33' N.$, *Long.* $98^{\circ} 29' E.$) and
- 35 the stony shoal which extends northward from Kalagyun. Yemyok, an island about $6\frac{1}{2}$ miles south-south-eastward of Sagyun, is covered with mangroves and lies in mid-stream with a drying spit extending about 3 cables northward from its northern point; the channel lies on the western side of Yemyok. Nga-Thôk kyun, an island on the
- 40 western side of the channel about half a mile south-westward of the southern end of Yemyok, is 148 feet (45^m1) high and wooded with a rounded summit. Payi kyun, about 2 miles south-south-westward of Yemyok, lies nearly in mid-stream with a mud spit which dries extending about $1\frac{1}{4}$ miles northward from its northern point, and a
- 45 drying sand flat extending about a similar distance south-south-westward from its south-western side.

- Thanbo, an islet 90 feet (27^m4) high, lies about $1\frac{1}{4}$ cables off the middle of the north-western side of Payi kyun; a rocky shoal bank extends about $1\frac{1}{4}$ cables eastward from Thanbo and on its south-
- 50 eastern extremity is a beacon, 12 feet (3^m7) high, surmounted by a black and white ball. Thila, an islet 65 feet (19^m8) high, lies on the western side of the channel, about 4 cables northward of Thanbo, and Mye-ni-kyun, 220 feet (67^m1) high, and also on the western side

Chart 1075.

of the channel, lies about a similar distance west-south-westward of Thanbo.

Kuntaungkyun, about 170 feet (51^m8) high, lies on the south-eastern side of the channel about 2 miles south-westward of the southern end of Payi kyun with which it is connected by a narrow ridge with depths of less than 6 feet (1^m8) ; a shoal with a least depth of 2 $\frac{3}{4}$ fathoms (5^m0) lies in the fairway of the channel about half a mile south-westward of the north-western point of Kuntaungkyun.

The southern entrance to Fell passage lies between the southern end of King island on the north, and Tatagyi, Tatangē and Pinbwa islands on the south. Tatagyi, lying about 1 $\frac{3}{4}$ miles south-westward of Kuntaungkyun, is described on page 436. Tatangē, an island 797 feet (242^m9) high, lies about half a mile westward of the northern part of Tatagyi. Lachi islands are a group of islets, the southernmost of which lies about 1 $\frac{1}{4}$ miles south-south-westward of Tatangē. Pinbwa, about 1 $\frac{1}{4}$ miles west-south-westward of Tatangē, forms the southern entrance point of Fell passage ; it has a summit 370 feet (112^m8) high, which is nearly flat with a slight dip in the middle. A mudbank, with depths of from 2 to 3 fathoms (3^m7 to 5^m5), extends about three-quarters of a mile westward from Pinbwa.

Tidal streams.—The tidal stream of the rising tide enters Fell passage at both ends, meeting about one mile northward of Nga-Thók-kyun. The stream sets north-eastward in the narrows northward of Payi kyun from 6 hours after to one hour before high water at Mergui with a rate of 1 $\frac{1}{4}$ knots at springs. For tidal streams in the southern approaches to Fell passage, *see* tidal streams in Bentinck route, page 451.

Directions.—Vessels should approach the northern entrance to Fell passage with the eastern extremity of Sagyun bearing 203°, and when about 2 cables eastward of the islet lying close northward of it, should alter course to about 195°. When nearing the north-western side of Kalagyun, they should keep at a distance of about 3 cables from it until the channel between Yemyok and King island opens ; the western side of the passage should then be gradually approached in order to avoid the shoal depths of 1 $\frac{1}{2}$ fathoms (2^m7) which exist north-eastward of the northern point of Yemyok, and a course shaped to pass about midway between the northern point of Yemyok and the eastern side of King island.

After passing a large double creek which does not dry, and when Sakoné (*Lat.* 12° 23' N., *Long.* 98° 26' E.), a wooded islet lying close eastward of Payi kyun, is seen open westward of Yemyok, bearing about 189°, course should be altered gradually southward and Sakoné kept on a bearing of 184°, when it should be open about twice its own length eastward of Nga-Thók-kyun. After passing close eastward of this latter island, the channel leads westward of the spit extending northward from Payi kyun and between it and Thila.

There is a passage on either side of Thanbo ; the eastern passage, although the narrower, is the easier when proceeding southward, as it is more direct. Vessels proceeding northward should use the western passage between Thanbo and Thila, taking care to avoid the shoal, with a least depth of 1 $\frac{1}{2}$ fathoms (2^m7), which lies about 1 $\frac{1}{2}$ cables north-westward of Thanbo.

Southward of Thanbo, the channel leads between Payi kyun and

Chart 1075.

Mye-ni-kyun, thence westward of Kuntaungkyun and of the $2\frac{3}{4}$ -fathom (5^m0) patch about half a mile south-westward of its north-western point, thence about midway between King island on the north and
 5 Tatagyi, Tatangē and Pinbwa on the south. Between King island and Tatangē and Pinbwa, the eddies are strong at springs.

*Charts 824, 216a.***NORTH-WESTERN APPROACH TO BENTINCK ROUTE.**

—**Caution.**—The north-western approach to Bentinck route lies
 10 between Elphinstone island and the southern part of King island and is encumbered with large numbers of islands and rocks. Great caution should be exercised when navigating in these waters as, owing to the irregular depths and the nature of the surrounding islands, other dangers than those charted may exist. Tide rips and
 15 cross currents are experienced around the islands.

Islands and dangers.—Anchorage.—The islands northward of a line joining the northern point of Elphinstone island and the southern point of Maingy island have been described on page 431.

Macleod island, lying close off the north-eastern side of Elphinstone
 20 island, is indented by several small bays which mostly dry; the island is densely wooded and hilly but has only one prominent summit which is 568 feet (173^m1) high, and lies on its north-western side. Off its north-eastern side there are two islets which are joined to the coast by a sand and coral reef which dries. Between Macleod island
 25 and Corbin island (page 431), about $2\frac{1}{4}$ miles northward, the depths are considerable and tide rips, overfalls and variable currents are experienced.

Swirl rock, about one mile eastward of Macleod island, is an isolated patch of rock, 5 feet (1^m5) high, from which a spit extends southward
 30 for about 7 cables; the depths between this rock and Macleod island are considerable.

Charts 1075, 216a.

Johnny island, about $3\frac{1}{2}$ miles south-eastward of Macleod island, is densely wooded, indented by several shallow bays, and fringed with
 35 reef. Good anchorage may be obtained, in a depth of 5 fathoms (9^m1), about one mile south-westward of its south-western point.

Charts 1075, 824, 216a.

Inside the triangle formed by Maingy, Macleod, and Johnny islands there are six small islands, all much the same in appearance, and
 40 densely wooded, the positions of which may best be seen on the chart. Robert Scott, Wilson, Evans, and Peter Scott islands form one group, and between them and Johnny island, and from $1\frac{1}{2}$ to 2 miles northward of the latter, are Wood and Daughish islands. A rocky patch, which dries, lies about 4 cables northward of Wilson island, and off the
 45 south-eastern point of Robert Scott island a reef extends south-eastward for about 3 cables. An isolated rock, which dries, lies about 3 cables northward of Wood island (*Lat.* $12^\circ 25' N.$, *Long.* $98^\circ 13' E.$), and a reef extends about 2 cables from its southern end. The reefs off the western and south-eastern ends of Daughish island extend for some
 50 distance; there is also a detached reef about $2\frac{1}{2}$ cables north-westward of this island.

Chart 216a.

There is a sheltered area of water between the eastern side of

Charts 830, 70.

Chart 216a.

Elphinstone island, on the west, the southern side of Macleod island, on the north, and the northern side of Grant's island, a densely wooded, hilly island, with no conspicuous summits, which is very nearly joined to Elphinstone island, on the south; the coastline of Grant's island is indented with small bays, which mostly dry about 5 feet (1^m5). Allan's, Paton's, Oates, and Bomford islands form the eastern side of the bay, and inside are numerous small islands, amongst which are Christobal, Sylvia and Grim islands.

The depths in the bay are irregular.

The entrance between Elphinstone and Macleod islands is only about 6 cables wide and should not be attempted, owing to rocks and foul ground which lie off the north-eastern end of Elphinstone island.

Great caution is necessary when entering the channel between Macleod and Bomford islands.

A rock, which dries about one foot (0^m3), lies about one cable east-north-eastward of Oates island.

Chart 1075.

La-ē-alē, about 8 cables south-south-eastward of Johnny island, has no distinctive summits; two islets lie between these two islands. La-ē-atet, lying close southward of, and almost joined to La-ē-alē, has a prominent peak, 727 feet (221^m6) high, which appears conical when seen from northward and which can be seen over Johnny island. La-ē-alē and La-ē-atet are both densely wooded.

Chart 216a.

Haycock island, 705 feet (214^m9) high, is the largest and highest of a group of small islands and rocky patches, lying from 2½ to 5½ miles westward of La-ē-atet; it is conical, steep-to and densely wooded. Other islands of this group, the positions of which may best be seen on the chart, are Rock, Flat, Humpty, Mouse, Dumpty and Rat islands. Mouse island, near the middle of the group, about 4½ miles westward of La-ē-atet, is 270 feet (82^m3) high, and must not be confused with another island of the same name, *see* below, lying about 2½ miles southward of La-ē-atet.

In the channel between Grant's island and the northern side of Ross island, about 2½ miles southward, there is a least charted depth of 3½ fathoms (5^m9) in the fairway; the greatest depths are close to Grant's island.

WESTERN APPROACH TO BENTINCK ROUTE.—Islands and dangers.—Anchorages.—Metcalf (Sir Charles Metcalfe) island, at the south-western entrance to Mermaid passage, and the islands between it and Cabusa (Kabosa) island, about 29 miles northward, have been described on page 429.

West Spur and East Spur, two islets about one mile apart in an east-west direction, with numerous sunken rocks between and around them, lie about one mile southward of Metcalfe island; the passage between Metcalfe island and these islets is foul.

Brunette, Greenlaw and Lion islands lie about 5, 8½ and 11½ miles, respectively, eastward of East Spur islet; Thankes island (*Lat.* 12° 15' N., *Long.* 98° 01' E.) lies about 2½ miles north-eastward of Lion island and close south-eastward of the southern extremity of Elphinstone island (page 430), with Shagstone about 1½ miles farther south-eastward. Extending about 5 miles southward from Shagstone in the order named,

Charts 830, 70.

Chart 216a.

are Knap, Basham, Middle and Pym islands. Knap and Basham islands lie close off the western side of Ross island, *see* page 441, the navigable channel between Basham island and the coast of Ross island being restricted to a width of about 3 cables by rocks, and having a least depth of 3 fathoms (5^m5). Pym island, steep-to and conical in shape, is about 400 feet (121^m9) high.

Bailey island lies about 7½ miles south-south-westward of Metcalfe island and about 11 miles eastward of it are the westernmost islets of a group which extends about 7½ miles eastward and includes Lump rock, Ninepin, South Ninepin, Clyde, Howe, Street, Warden, Lyall, Henry and Quoin islands, the positions of which may best be seen on the chart. Howe and Clyde islands are joined by a rocky ridge; Quoin island has a double peak and a rocky spit extends off the eastern end of the island; Warden island, the largest and highest of the group, attains an elevation of 808 feet (246^m3).

Hattras (Hattrass) passage lies between West Spur and East Spur on the north, and Bailey island on the south.

Prinsep (H. Prinsep) island lies about 5 miles south-westward of Bailey island; on its northern point is Tower rock, which is an excellent landmark. Sergeant (Sargent) island lies about half a mile south-eastward of Prinsep island and is higher than the latter, having an elevation of about 1,200 feet (365^m8); the passage between Prinsep and Sergeant islands is foul. Chester island and Mackenzie island lie about 4 miles eastward, and 3½ miles east-south-eastward, respectively, of Sergeant island; in 1940, reefs were observed extending some distance southward of the south-western extremity of Chester island and they may extend across the passage between it and Mackenzie island. Observation island, densely wooded, lies about 9 miles eastward of Mackenzie island.

Courts island, 1,130 feet (344^m4) high, lies about 3 miles east-south-eastward of Observation island and from south-westward its summit resembles a volcanic cone; its northern coast is apparently foul. During the South-west monsoon, anchorage may be obtained off a sandy beach which is foul for about three-quarters of a cable offshore, in depths of 4 or 5 fathoms (7^m3 or 9^m1), in a bay on the north-eastern side of the island, about 2 miles northward of its southern extremity. During the North-east monsoon, good anchorage in a depth of 5 fathoms (9^m1) may be obtained off a sandy beach at the eastern side of the head of the bay on the southern side of Courts island.

East islet and West islet lie about 2½ miles southward, and about 5 miles south-westward, respectively, of Mackenzie island. Lunka rock, which dries 6 feet (1^m8), lies about 8½ miles east-south-eastward of East islet and about 5 miles west-south-westward of the western end of Courts island.

Hayes (Sir John Hayes) island, 1,596 feet (486^m5) high, lies about 7 miles southward of Sergeant island, with Fletcher island about three-quarters of a mile southward of it.

Great Western Torres are the westernmost islands of Mergui archipelago, being situated as much as 12 miles westward of Fletcher island. The two largest islands of the group are separated by a channel near the south-eastern end, at the narrowest part of which the navigable width is reduced to about half a cable by a fringing reef on either side; there is a least depth of 3 fathoms (5^m5) in mid-channel, and depths

Chart 216a.

of $5\frac{1}{2}$ fathoms (10^m1) are found slightly southward of mid-channel.

Half-way through the channel, a cove (*Lat.* $11^\circ 47' N.$, *Long.* $97^\circ 28' E.$), the sides of which are fringed with coral, extends about 3 cables into the south-western island, with depths decreasing from 12 fathoms (21^m9) off its entrance to 7 fathoms (12^m8) near the head, which is filled with sand.

Vessels of too great a length to moor in the cove may obtain anchorage off its entrance, in depths of from 15 to 18 fathoms (27^m4 to 32^m9), but the holding ground is indifferent and this position is open to the swell; small vessels can moor inside the cove. Vessels should enter the north-western end of the channel with N.E. Little Torres islet, *see below*, bearing 131° , seen through the south-eastern entrance, and when the cove opens should anchor as convenient.

A rock, awash, charted about one mile eastward of the northern island of the Great Western Torres group, was clearly seen from H.M.S. *Effingham* in 1931.

Little Torres islands consist of N.E. Little Torres, with a reef about half a mile westward of it, and three other islets, situated in an ellipse between $4\frac{1}{2}$ miles south-eastward and 10 miles southward of Great Western Torres islands; the positions of the three southern islets are doubtful. The second islet from southward appears double and has a needle-shaped rock close off it. Vessels should not approach within 3 miles of the Little Torres group.

Nearchus rock, situated about 13 miles east-south-eastward of Fletcher island, is covered at high water.

Black rock and islets south-south-eastward of Nearchus rock are described on page 449.

Nearchus passage.—Directions.—Nearchus passage lies between Fletcher island, Lunka rock and Courts island on the north, and Great Western Torres, N.E. Little Torres, Nearchus rock and Bentinck island on the south. For Bentinck island, *see* page 446; the peak on its northern point is not conspicuous from Nearchus passage.

The following is the track recommended for vessels proceeding to Bentinck route and using Nearchus passage:—From a position about 2 miles northward of Great Western Torres, course should be shaped to pass about $1\frac{1}{2}$ miles southward of Fletcher island, thence about one mile southward of Courts island, and thence about one mile north-westward of Christmas island, which is situated about 9 miles east-north-eastward of Courts island and where the track joins Bentinck route.

Charts 1075, 216a.

BENTINCK ROUTE.—Bentinck route leads from the southern end of Fell passage (page 439) to the northern end of Forrest strait, about 90 miles southward, passing between Bentinck island on the west and Domel island on the east. For tidal streams in Bentinck route, *see* page 451.

Chart 1075.

Pinbwa island to Christmas island.—Islands and dangers.—Pinbwa island and the Lachi islands have been described on page 439 and Shrub rocks on page 436.

Mouse island (*Lat.* $12^\circ 15' N.$, *Long.* $98^\circ 16' E.$), 173 feet (52^m7) high and conical, lies about $2\frac{1}{4}$ miles southward of La-ê-atet and about $5\frac{1}{2}$ miles south-westward of the southern end of Fell passage; Mayan,

Charts 216a, 830, 70.

Chart 1075.

an island 203 feet (61^m9) high, lies about one mile eastward of Mouse island. Medina patches, with a least depth of $1\frac{1}{2}$ fathoms (2^m7), gravel, lie on a bank of sand and mud which, with depths of less than 5 fathoms (9^m1), extends about 3 miles east-south-eastward from Mayan. Lump rock, 20 feet (6^m1) high, lies about $1\frac{1}{4}$ miles southward of Mouse island and White rock, 12 feet (3^m7) high, lies about $1\frac{1}{2}$ miles south-westward of the same island.

Yengē kyun, 359 feet (109^m4) high, is situated about $3\frac{1}{2}$ miles southward of La-ē-atet; a rock, with a depth of less than 6 feet (1^m8) over it, lies about $1\frac{1}{4}$ miles east-north-eastward of the southern extremity of the island with foul ground between.

Mergui (Merghi) islands, on the south-eastern side of Bentinck route, about 8 miles east-south-eastward of Yengē kyun, have been described on page 436, and Auckland bay, on the south-eastern side of Mergui islands, has been described on page 437.

Chart 216a.

Hext rock, about $4\frac{1}{4}$ miles southward of Yengē kyun and on the south-eastern side of the fairway of Bentinck route, has a depth of one foot (0^m3) over it and is usually marked by a ripple. The summit of Yengē kyun in line with the peak of La-ē-atet, bearing 002°, leads westward of Hext rock (*Lat.* 12° 08' N., *Long.* 98° 16' E.).

The southern point of Ross island lies about 7 miles west-south-westward of Yengē kyun and the eastern coast of the island extends about 9 miles northward from it; the northern end of this coast is foul with drying rocks for a distance of from 5 to 10 cables offshore. McClelland, Griffiths and Hel-fer islands lie between Yengē kyun and the eastern coast of Ross island.

Martin island, 209 feet (63^m7) high, lies about $1\frac{1}{2}$ miles southward of the southern point of Ross island with two islands between. Mewstone, Lloyds, Drakes and Criddles islands, the positions of which may best be seen on the chart, lie between $6\frac{1}{2}$ and $11\frac{1}{2}$ miles west-south-westward of Martin island; the area between Drakes, Lloyds and Criddles islands is foul. A rock, 15 feet (4^m6) high, lies close off the north-western end of Criddles island and Button island, 55 feet (16^m8) high, lies about 2 miles eastward of the southern end of the same island.

Christmas island, about $6\frac{1}{2}$ miles southward of Martin island and 450 feet (137^m2) high to the tops of the trees, lies on the eastern side of the fairway and is the north-westernmost of a group of islets and rocky patches; it is densely wooded and its summit is prominent from southward. Shoal depths extend about half a mile north-eastward from the indented northern side of the island, while the southern side is bold, with off-lying rocks. The western side of the island may be passed at a distance of about half a mile but the tidal stream which runs during the rising tide must be guarded against.

Double rock, 45 feet (13^m7) high, a bare rock with two peaks, lies about $2\frac{1}{2}$ miles east-north-eastward of Christmas island; Single rock, 15 feet (4^m6) high, lies about half a mile northward of Double rock.

Christmas island to Bentinck island.—Islands and dangers.—Courts island, on the western side of the fairway of Bentinck route about 8 miles west-south-westward of Christmas island, has been described on page 442.

Pickwick island, 415 feet (126^m5) high, and Weller island, 320 feet

Chart 216a.

(97^m5) high, the westernmost islands of the Pickwick group, lie about 5½ miles eastward of Christmas island; they are densely wooded.

This group lies on the western side of the entrance to Morrison bay, described on page 452. Between Weller island and the northern extremity of Parker island, about half a mile southward, are two bare rocks, 25 feet (7^m6) and 20 feet (6^m1) high, and there are dangerous eddies at springs in their vicinity.

Basin island, 260 feet (79^m2) high, lies about one mile south-eastward of Christmas island; it is sparsely wooded on its northern end.

Holly island, 130 feet (39^m6) high, lies about 2 miles eastward of Christmas island; it is wooded and has a prominent summit; a rocky reef extends about 3¼ cables southward from it.

Stodart rock, a small pinnacle rock with a depth of 6 feet (1^m8) over it, lies about 2½ miles southward of Holly island.

Parker, Trotter and Money islands lie southward of the Pickwick group and form the eastern side of the Bentinck route; the islands are densely wooded and their western coasts are indented with small sandy bays; they are described, with Morrison bay, on page 453. Between Parker and Trotter islands is a deep channel, about half a mile wide, through which the tidal stream runs strongly. The channel between Trotter and Money islands almost dries. The channel between the northern end of Domel island (page 447) and Money island is deep and rather narrow.

Amie island, 560 feet (170^m7) high and densely wooded, lies about 4¾ miles south-eastward of Christmas island and has a prominent summit. Williams reef, which dries 4 feet (1^m2), lies about 1¾ miles south-westward of Amie island, and Biddy rock, with a depth of 16 feet (4^m9), lies about 1½ miles farther south-westward. Warning rock, which dries 2 feet (0^m6), lies on the western side of the fairway about 6¾ miles south-south-westward of Christmas island; the track of Bentinck route leads about midway between Biddy and Warning rocks.

Whale rock (*Lat.* 11° 52' N., *Long.* 98° 05' E.), 30 feet (9^m1) high, lies about 1¾ miles southward of Warning rock. Zahora rock, awash, and steep-to, lies about 1¼ miles northward of the northern end of Bentinck island (page 446).

Marian island lies about 5 miles southward of Amie island; it is sparsely wooded and its most prominent summit is at its western end, 470 feet (143^m3) high; on the eastern end of this island are two grassy summits, 510 feet (155^m4) and 505 feet (153^m9) high, the saddle between which is distinctive from southward. Between Marian and Amie islands is a group of islands and rocks, including Rosy island, which has a prominent summit on its north-western side, 485 feet (147^m8) high, and Biddy island, 165 feet (50^m3) high, which is a double island, connected by a causeway. Eastward of this group of islands is a channel about 2 miles wide, in which there are a number of reefs and islets.

A pinnacle rock, with a depth of 11 feet (3^m4) over it, lies about 1¾ miles southward of Marian island, and between them are several islets and rocks.

Elephant island, 190 feet (57^m9) high, situated on the eastern side of the fairway, lies on the eastern extremity of a spit which, with depths of 3 fathoms (5^m5) and less, extends about 1¾ miles

Chart 216a.

south-westward of Marian island ; it is wooded and appears flat-topped from a distance, but is really of very peculiar shape.

Cap and Feathers, a single rock, 45 feet (13^m7) high, lies three-quarters of a mile north-westward of Elephant island ; about half a cable westward of it is a rock which dries 10 feet (3^m0). A shoal, with a depth of 3 fathoms (5^m5), lies about half a mile northward of Cap and Feathers.

Peterson rock, which dries 6 feet (1^m8), lies on the western side of the fairway, about 3½ miles westward of Elephant island. Crown island, 200 feet (61^m0) high, and steep-to on its northern side, lies about 1½ miles westward of Peterson rock. West Passage island, 480 feet (146^m3) high, lies about 2½ miles west-south-westward of Elephant island ; it is bold and wooded, and is steep-to on its eastern side. Dennis rock, 13 feet (14^m0) high, is situated about one mile west-south-westward of West Passage island, and is steep-to.

Bentinck island.—Off-lying islets and rocks.—Anchorages.—

Bentinck island, the northern point of which lies about 4½ miles southward of Courts island, is situated on the western side of the fairway of Bentinck route, and is densely wooded and hilly with several high summits. Machai, 965 feet (294^m1) high, a bold, flat-topped hill, about 2 miles within the northern point of the island, and a peak 1,015 feet (309^m4) high, about 2½ miles south-south-eastward of it, are the most prominent in the northern part of the island ; the latter appears like a horn on north-easterly and south-westerly bearings. About 10 miles south-south-westward of the 1,015-foot (309^m4) peak and about 1½ miles north-north-westward of Bluff point, the southern extremity of the island, is a hill 885 feet (269^m7) high, which is the most prominent summit in this part of the island.

North bay, on the northern side of Bentinck island, is well protected and affords excellent anchorage in depths of from 6 to 15 fathoms (11^m0 to 27^m4), mud.

Thomson island, 1,000 feet (304^m8) high and densely wooded, forms the eastern side of North bay and is separated from Bentinck island by a narrow channel in which there is a least depth of one fathom (1^m8). South Passage island (*Lat.* 11° 46' N., *Long.* 98° 07' E.), situated on the western side of the fairway about 3½ miles southward of West Passage island and about 1½ miles off the eastern extremity of Bentinck island, is bold and wooded ; a reef which dries 2 feet (0^m6) lies about 4 cables north-eastward of the northern point of South Passage island with shoal depths between them. Doris rock, which dries 4 feet (1^m2), and Daphne rock, which is awash, lie about 6 and 4½ miles, respectively, northward of Bluff point and about half a mile off the eastern coast of Bentinck island.

During the dark rainy nights which occur in the period of the South-west monsoon, power vessels may obtain anchorage, in depths of from 6 to 8 fathoms (11^m0 to 14^m6), about midway between West and South Passage islands and about 2 miles eastward of the south point of Thomson island.

There are two inlets in the southern part of the eastern side of Bentinck island, situated about 4 and 2½ miles, respectively, northward of Bluff point ; well sheltered anchorage may be obtained in the northern arm of the southern inlet, in a depth of 6 fathoms (11^m0).

There are several rocks lying off the southern end of Bentinck island ;

Chart 216a.

Perforated rock, 195 feet (59^m4) high and bare, situated about 1½ miles west-south-westward of Bluff point, is the largest, and Fish rock, 10 feet (3^m0) high, lying about one mile south-south-westward of Perforated rock, is the southernmost.

The western coast of Bentinck island is rugged, wooded and much indented. Several islets are situated off this coast, amongst which are Peak island, about 9 miles north-westward of Bluff point and about 2 miles offshore, and Charlotte island, about 7½ miles west-north-westward of Bluff point and about 2½ miles offshore.

Two inlets, situated about 9 and 7 miles, respectively, north-north-westward of Bluff point, indent the western coast of Bentinck island. During the North-east monsoon, good anchorage may be obtained in a depth of 5 fathoms (9^m1) in a bay on the northern side of the northern of these inlets; an arm, which is shallow, extends southward on the southern side of the head. About one mile within the entrance to the southern inlet and on its southern side, an arm extends southward with a depth of 7 fathoms (12^m8) in the entrance; good anchorage, in a depth of 4 fathoms (7^m3), may be obtained near the head of this arm, the shores of which are fringed to some distance offshore with coral. Anchorage may also be obtained, in a depth of 4 or 5 fathoms (7^m3 or 9^m1), in a bay on the northern side of the inlet, opposite the entrance to the arm. The head of this inlet is shoal.

On the south-western coast of Bentinck island, about 4½ miles north-westward of Bluff point, is an inlet fringed with coral, the entrance to which is obscured from seaward by islets; good anchorage, in a depth of 8 fathoms (14^m6), may be obtained in this inlet.

Domel island. — Anchorage. — Off-lying island. — Domel island lies roughly parallel with Bentinck island at a distance varying from 7 to 13 miles eastward of the latter island; its western coast is bold and indented with many sandy bays. The island is densely wooded and mountainous with several distinctive summits including, from north to south, Aveline hill 1,610 feet (490^m7), McClement hill 1,600 feet (487^m7), Sanderson hill 1,765 feet (538^m0), and Charles Ross hill 2,240 feet (682^m8) high; with the exception of Sanderson hill, which is bare rock, these summits are all densely wooded.

Livock bay, a bight in the southern coast of the island near its south-eastern extremity, affords good anchorage during the South-west monsoon, in a depth of 4 fathoms (7^m3) in its northern arm.

Pigeon island (*Lat.* 11° 47' N., *Long.* 98° 13' E.), 390 feet (118^m9) high at its northern end and wooded, lies about 3 miles westward of the north-western point of Domel island; a spit extends about 4 cables northward from the northern end of the island.

Chart 3051.

Domel island to Bernard island.—Islands and dangers.—

Anchorage.—High Peaked island, situated on the eastern side of the fairway of Bentinck route about one mile westward of the south-western extremity of Domel island, has a distinct summit, which is 990 feet (301^m8) high and densely wooded. About 4 cables northward of the northern end of High Peaked island is 2nd Observation islet, 230 feet (70^m1) high, which is cliffy and wooded. Within half a mile north-eastward of 2nd Observation islet are two islets, the southern of which, Mosquito islet, 45 feet (13^m7) high, has a rock, which dries

Chart 3051.

10 feet (3^m0), lying close south-westward of it ; the northern, 75 feet (22^m9) high, is named Fly islet. Fly rock, about 2½ miles north-westward of Fly islet, is a small pinnacle rock ; it is steep-to on all
 5 sides and is very difficult to see at ordinary low water. A rock, which dries 8 feet (2^m4), lies about 1½ miles east-south-eastward of 2nd Observation islet.

Tree island lies about 9 miles south-westward of Bluff point (chart 216a), the southern point of Bentinck island ; North-west islet lies
 10 about 3½ miles farther west-south-westward ; Flat islet lies about 1½ miles south-westward of Tree island.

The Sisters are a group of islands and numerous islets and rocks, mostly wooded and uninhabited, lying on the western side of the fairway from about 9 miles westward to 11 miles south-westward
 15 of the south-western extremity of Domel island ; the western sides of the islands are rocky and precipitous, but there are sandy beaches on the eastern sides of the larger islands. Maria island, the northernmost, has four distinct summits, of which the north-eastern is 600 feet (182^m9) high. Within half a mile northward of the north-western
 20 point of the island are two islets, the southern of which is 160 feet (48^m8) high and the northern and larger, which has a reef about half a mile westward of it, is 150 feet (45^m7) high. Close off the north-eastern extremity of the island is a rock, 55 feet (16^m8) in height. Violet island, wooded and with a grassy summit, 320 feet (97^m5)
 25 high, lies about half a mile south-eastward of Maria island, and between these two islands are several rocks, varying in elevation from one foot to 120 feet (0^m3 to 36^m6).

During the South-west monsoon good anchorage may be obtained in a bay on the northern side of Maria island about half a mile south-
 30 south-eastward of its north-western extremity, in a depth of 7 fathoms (12^m8), sand.

Maria rock (*Lat.* 11° 26' N., *Long.* 98° 02' E.), 45 feet (13^m7) high, which has a rock, 20 feet (6^m1) high, about one cable north-westward of it, lies 9 cables eastward of Violet island. Eliza island, the next in the
 35 group, is 670 feet (204^m2) high, and about one mile eastward of its south-eastern extremity is North-east Quoin, 185 feet (56^m4) high. About one mile northward of North-east Quoin lies Eliza rock, a bare rock, 35 feet (10^m7) high. Umbrella rock, 75 feet (22^m9) high, lies about 6 cables south-south-eastward of North-east Quoin and a rock, which
 40 dries 2 feet (0^m6), lies about three-quarters of a cable southward of it. Jane rock, a bare rock, 40 feet (12^m2) high, with a smaller rock about half a cable north-westward of it, lies about 7 cables south-south-eastward of Umbrella rock ; a rock, 10 feet (3^m0) high, lies about 2 cables south-south-eastward of Jane rock.

45 About one mile southward of Eliza island is Jane island, 680 feet (207^m3) high, and about 4 cables south-eastward of Jane island is Janet islet, densely wooded and 290 feet (88^m4) high, between which are two rocky ledges.

Anne island, 670 feet (204^m2) high, lies about half a mile southward
 50 of Jane island ; two isolated unnamed rocks lie about 3½ miles westward of the northern point of Anne island. Charlotte island, 515 feet (157^m0) high, lies southward of Anne island, from which it is separated by a channel about one cable wide which has a small rock on either side of it. A rock, 100 feet (30^m5) high, lies about one cable southward

Charts 216a, 830, 70.

Chart 3051.

of Charlotte island, and Charlotte rock, a bare rock, 70 feet (21^m3) high, lies about 4 cables east-north-eastward of Charlotte island.

During the South-west monsoon good anchorage may be found in a bay about half a mile south-south-eastward of the northern extremity of Anne island, in a depth of 8 fathoms (14^m6), sand.

May island, densely wooded and 135 feet (41^m2) high, lies about three-quarters of a cable eastward of Charlotte island, and South Quoin, 255 feet (77^m7) high, lies about one cable southward of May island. Pin island, very steep-to and densely wooded, is the southernmost of 10 The Sisters group: it is 205 feet (62^m5) high, and lies about 2 cables east-south-eastward of South Quoin. Celia rock, awash, lies about 2 miles east-north-eastward of South Quoin.

Hen and Chickens are a group of rocks, lying about 2 miles southward of The Sisters; the southern and largest rock is 50 feet (15^m2) 15 high.

Cooper's Driver, a rugged and partly wooded island, lies about 6 miles westward of Hen and Chickens. Except for a small islet lying close off the south-western point, the eastern and western sides of the island are steep-to. Close off the northern point of the island 20 is a bare islet which is connected by a chain of rocks with a similar islet about one mile eastward; strong eddies form in their vicinity during the strength of the tidal stream.

Black rock, an isolated rock which is visible from a distance of about 8 miles, lies about 17 miles west-north-westward of Cooper's 25 Driver and about 15½ miles south-eastward of the southernmost Little Torres island (page 443).

Son island and Father island, 350 and 610 feet (106^m7 and 185^m9) high, respectively, are two bare islands situated close together on the western side of the fairway about 5½ miles south-eastward of Hen and 30 Chickens; the cliffs on the southern and western sides of Father island are conspicuously streaked with red. A rock, 3 feet (0^m9) high, lies about 6 cables northward of Son island, and about 3 cables northward of this rock are two other rocks, which dry 8 feet (2^m4).

Bushby island, situated on the eastern side of the fairway about 35 2 miles south-south-westward of the south-western extremity of Domel island, is bold, with many wooded summits, the highest of which, close to its eastern side, has an elevation of 1,005 feet (306^m3). Cone islet, 215 feet (65^m5) high, densely wooded and conical, lies about 1½ miles southward of the western extremity of Bushby island. Bushby 40 island abounds with wild pig.

Constitution bank, with a least depth of 41 feet (12^m5), lies in the fairway between The Sisters and Bushby island.

Anchorage may be obtained by vessels with local knowledge, in a depth of 8 fathoms (14^m6), just outside a line joining the points of 45 a small sandy cove at the north-western point of Bushby island.

Dorothy island, 280 feet (85^m3) high, lies about 2 miles east-south-eastward of the north-eastern point of Bushby island. Within about 6 miles eastward and a similar distance east-south-eastward of Dorothy island is a group of islands and rocks which include Carew island, 50 590 feet (179^m8), North Park island, 525 feet (160^m0), South Park island (*Lat.* 11° 24' N., *Long.* 98° 16' E.), 675 feet (205^m7), Ravenshaw island, 990 feet (301^m8), and Wendy island, 185 feet (56^m4) high; Alligator rock, 15 feet (4^m6) in height, lies about 1½ miles eastward

Charts 216a, 830, 70.

Chart 3051.

of Ravenshaw island. Between about 2 and 10 miles southward of this group are Sir J. Malcolm, Sir E. Owen and Bernard islands, all densely wooded.

- 5 Jubilee channel is an excellent passage running in an east-north-easterly and west-south-westerly direction between Ravenshaw and Sir J. Malcolm islands. It has a least width of 9 cables at its eastern end, between Alligator rock and the northern extremity of Sir J. Malcolm island, and there are considerable depths in the fairway.
- 10 Katharine island, which is 245 feet (74^m7) high and wooded, lies at the south-western entrance to Jubilee channel. Vessels can pass either northward of it or between it and Barbara island, a densely wooded island, 206 feet (79^m2) high, about 1½ miles southward. The tidal stream runs strongly through Jubilee channel, *see* page 451.
- 15 Sir J. Malcolm island has two distinct summits, the north-eastern of which is 1,230 feet (374^m9) high, and the south-western 1,235 feet (376^m4) high.

A rock, which dries 5 feet (1^m5), lies about 6 cables west-south-westward of Barbara island.

- 20 Southward of Barbara island and close to the south-western extremity of Sir J. Malcolm island are three islets, 180 feet (54^m9), 130 feet (39^m6) and 200 feet (61^m0) high, respectively. In the centre of an inlet on the eastern side of the island is an islet, 255 feet (77^m7) high.
- 25 Paine's reef, a coral reef which dries 7 feet (2^m1), lies about one mile eastward of the north-eastern side of Sir J. Malcolm island. A rocky patch, with a depth of less than 6 feet (1^m8) over it, lies about 1½ miles southward of Paine's reef. Haldane island, 135 feet (41^m1) high, and densely wooded, lies about 2½ miles north-eastward of the north-eastern extremity of Sir E. Owen island.

There is a navigable passage, 3½ cables wide, between Sir J. Malcolm and Sir E. Owen islands, but, owing to reefs eastward of it, it should not be used in preference to Jubilee channel.

- 35 Sir E. Owen island has three distinct summits, the northern and centre of which are 1,550 feet (472^m4) high. In Sinclair bay, on the western side of the island, there is a sandy beach about one mile long. Excellent anchorage may be obtained by vessels with local knowledge during the North-east monsoon, in a depth of 8 fathoms (14^m6), sand, about half a mile westward of a small bluff in the centre of the head
- 40 of the bay. Immediately southward of Sinclair bay is Juna bay, the shore of which consists mostly of rocky ledges; anchorage may be obtained by small vessels with local knowledge, in a depth of 9 fathoms (16^m5), in the entrance to this bay.

- Joan island, 195 feet (59^m4) high, about three-quarters of a mile eastward of the north-eastern extremity of Sir E. Owen island, and
- 45 Doris island, 280 feet (85^m3) high, about 1½ miles eastward of the northern summit and one cable offshore, are densely wooded. A reef, which dries 10 feet (3^m0), lies about 8 cables eastward of the eastern extremity of Sir E. Owen island.

- 50 Close southward of Sir E. Owen island are three small islands, Maxwell island, 340 feet (103^m6), Milne island, 240 feet (73^m2) and Bain island, 120 feet (36^m6) in height; the two former are densely wooded. Bernard island (*Lat.* 11° 11' N., *Long.* 98° 16' E.), also densely wooded and 625 feet (190^m5) high, lies about half a mile south-

Chart 3051.

ward of Sir E. Owen island, and between them is a channel, which has a least depth of 15 fathoms (27^m4).

A bank, with a least depth of 37 feet (11^m3), extends about 3½ miles westward from the western side of Sir E. Owen island, and a bank, with a least depth of 47 feet (14^m3), lies about 1½ miles westward of the southern end of Bernard island (*Lat.* 11° 10' N., *Long.* 98° 15' E.).
Charts 1075, 216a.

Tidal streams in Bentinck route.—In the northern approaches to Bentinck route the tidal streams set south-south-eastward on the rising and north-north-westward on the falling tide, with rates of about 2 knots in open waters. In the narrow channels tide rips, eddies and overfalls occur.

Near the southern entrance to Fell passage and in the vicinity of Shrub rocks, the tidal streams set eastward on the rising and westward on the falling tide, with rates of about 2 knots.

Between Shrub rocks and the Pickwick group the tidal streams set south-eastward on the rising and north-westward on the falling tide. Rates of from 4 to 5 knots have been reported at springs.

Between Courts island and Parker island the tidal streams set north-eastward on the rising and south-westward on the falling tide, with rates at springs of 1½ knots and 1¾ knots, respectively. There is a set on to the south-western side of Christmas island during the rising tide.

Between Bentinck island and Domel island, northward of West Passage island, the tidal streams set north-eastward on the rising and south-westward on the falling tide, with rates at springs of about 2 knots. In the more open waters north-eastward of South Passage island, the tidal streams set northward on the rising and southward on the falling tide, with rates at springs of about one knot. About 4 miles southward of Bluff point, the tidal stream at the beginning of the rising tide sets east-south-eastward and then turns gradually through east to north-east. During the falling tide the stream sets west-south-westward. The rate of both streams at springs is about 1½ knots.

Eastward of Maria island the streams set south-eastward during the rising and north-westward during the falling tide, with rates at springs of about 1½ knots. Between Carew and Domel islands the streams set north-eastward during the rising and south-westward during the falling tide with rates at springs of over 3 knots. The streams are also strong between High Peaked and Bushby islands and in Jubilee channel. Tide rips occur in the latter, especially off the eastern entrance. Between Bushby and Sir E. Owen islands, the streams set north-eastward or east-north-eastward during the rising tide and in the reverse directions during the falling tide with rates at springs of about 1½ knots.

Directions for Bentinck route.—Vessels proceeding southward from Fell passage through Bentinck route should pass about half a mile westward of Pinbwa island and should then bring the south-western point of King island in line with the sharp peak on Maingy island, bearing 340°, and should keep these marks in line astern; when Shrub rocks bear 046°, course should be altered westward to make good 229° until the southern extremity of Yengē kyun bears 316°, distant about 1½ miles, when course should be altered to make good 222°, which leads about one mile north-westward of Christmas

Charts 1075, 216a.

island. Small vessels may cross the bank eastward of Medina patches by keeping the eastern side of Pinbwa island open north-westward of Tatangē and bearing less than 034°.

5 *Chart 216a.*

The double peak at the southern end of Ross island kept well open southward of the southern extremity of Yengē kyun, leads southward of the banks which extend eastward of the latter island.

Between Yengē kyun and Hext rock vessels must guard against
10 being set southward.

So far as is known, there are considerable depths in the fairway between Christmas island and The Sisters, except in the vicinity of West Passage island, but as the channels have only been partially examined, caution is necessary and vessels should sound continuously.

15 From a position one mile westward of Christmas island, course should be shaped to make good 176°, which leads about midway between Warning rock and Biddy rock and between Cap and Feathers rock and West Passage island; in shaping this course, allowance must be made for the tidal streams, *see* page 451, as soundings give little
20 warning of the approach to dangers in this area.

The least depth in the fairway between West Passage island and Elephant island is $3\frac{1}{2}$ fathoms (6^m4); in the vicinity of West Passage island, the greatest depths are near the island. When the summit of South Passage island bears 270°, course should be shaped to make
25 good about 195°, passing about half a mile off Bluff point; when the latter point comes in line with the western end of South Passage island, bearing 005°, course should be altered to about 185°, and these marks kept in line astern, passing about one mile westward of Fly rock.

30 *Chart 3051.*

When Fly islet (*Lat. 11° 29' N., Long. 98° 08' E.*) bears 090°, distant about 3 miles, course should be shaped 180° to pass about $6\frac{1}{2}$ cables westward of Cone islet. When the summit of Jane island bears 279°, course should be shaped to make good 152° which passes about $1\frac{1}{2}$ miles
35 north-eastward of Celia rock, about 4 miles north-eastward of Father island, and about 2 miles south-westward of High island, *see* page 460, situated at the entrance to Forrest strait, about 8 miles south-south-eastward of Bernard island. For tidal streams between High Peaked island and Bushby island, and between the latter island and
40 High island, *see* pages 451 and 460.

South Passage island is not easily distinguished from southward, and vessels proceeding northward should keep Cone islet bearing not more than 180° and well open westward of Bushby island until Fly rock is passed.

45 *Chart 216a.*

MORRISON BAY AND SOUTHERN APPROACH.—General remarks.—The entrance to Morrison bay lies between the Pickwick group of islands (page 445) and Saunggyi kyun (page 436) about 10 miles north-eastward, and the bay extends south-eastward for
50 about 15 miles to Julian, Kennedy and Tucker islands near its head. It is bounded on the west by Parker, Trotter and Money islands (page 445), on the east by Sellore island (page 437), and on the south by the northern side of Kisseraing island, which lies between 3 and

Charts 830, 70.

Chart 216a.

9 miles eastward of Domel island. Morrison bay may also be entered from southward by a narrow channel which is approached between Domel and Kisseraing islands and leads, between flats extending from the northern parts of these islands, into the south-western corner of Morrison bay. 5

Western side of Morrison bay.—Islands and dangers.—Parker island, situated about half a mile southward of the southernmost of the Pickwick group, attains an elevation of 620 feet (189^m0) near its southern point and is densely wooded. There are numerous islets off the eastern side of Parker island; Edmund and Wilmot islands lie close together about half a mile off its north-eastern coast; Pirie island, conical and densely wooded, lies about one mile north-eastward of the eastern extremity of Parker island, with Tree island about half a mile north-westward of it; a shoal spit extends about half a mile northward from Tree island. Star island, which lies about three-quarters of a mile east-north-eastward of the southern extremity of Parker island, is the northern and outermost of a group of five islands which lie close off the south-eastern end of Parker island; Reef island, about half a mile eastward of the northern point of Trotter island, is the southernmost of this group and about a quarter of a mile eastward of it is a mangrove islet. 10 15 20

Trotter island, about half a mile southward of Parker island, is 1,070 feet (326^m1) high, and is also densely wooded. Whaleback reef, which dries 5 feet (1^m5), lies about one mile northward of the eastern extremity of Trotter island; there are shoal patches north-north-westward and south-westward of the reef but there are considerable depths off its eastern side and there are moderate depths close off the eastern extremity of Trotter island. Heath rock, with a depth of 5 feet (1^m5) over it, lies about 1 $\frac{3}{4}$ miles north-north-eastward of the eastern extremity of Trotter island and can usually be distinguished by the eddies over it; Forfar rock, 4 feet (1^m2) high, lies on a patch of rocky ground about 1 $\frac{3}{4}$ miles east-north-eastward of the same point; the patch is surrounded by depths of 5 $\frac{1}{2}$ and 6 $\frac{1}{2}$ fathoms (9^m6 and 11^m4). 25 30 35

Money island, also densely wooded and 1,110 feet (338^m3) high, lies close southward of Trotter island; there are several small indentations fringed with mangroves on its eastern side. Southward of Money island and near the middle of the channel between it and Domel island is a wooded islet. 40

Una islet (*Lat.* 11° 52' N., *Long.* 98° 18' E.) lies about one mile north-eastward of the north-eastern extremity of Money island. Jack island, which lies between them, is sparsely wooded and has a fishing village on its northern side. The channel between Jack and Una islands is about 2 cables wide but none of the channels between these islands should be used as the tidal streams are strong and irregular. 45

Eastern side of Morrison bay.—Islands and dangers.—Kayo (Hay island), 170 feet (51^m8) high, lies on the eastern side of the bay about 2 miles south-westward of the north-western extremity of Sellore island. Donnelly reef, which dries about 4 feet (1^m2), lies about 8 miles southward of Kayo and about 2 miles off the eastern shore of the bay; between this reef and Kayo and within a distance of about 2 $\frac{1}{2}$ miles of the eastern shore of the bay are several shoal patches, 50

Chart 216a.

the positions of which may best be seen on the chart. Donnelly island, about 2 miles southward of Donnelly reef, is 155 feet (47^m2) high and well wooded; it marks the north-eastern side of a channel 5 which leads between Julian and Kennedy islands, *see* below.

Wright island, which lies between Donnelly island and the eastern shore of the bay, is also well wooded; there are considerable depths in the channel between Wright island and Donnelly island but the tidal streams in it are strong and irregular. Twins rocks, 30 feet 10 (9^m1) high, lie about three-quarters of a mile south-south-eastward of Donnelly island, and Bird rocks, 4 feet (1^m2) high, about 4 cables farther southward, are white in colour and steep-to.

Head of Morrison bay.—Islands and dangers.—Beacon.—

The northern coast of Kisseraing island, which forms the head of 15 Morrison bay, is fronted at a distance of from one to 2 miles by Julian, Kennedy and Tucker islands. Julian island, the south-western point of which lies about 3 miles north-eastward of the north-western point of Kisseraing island, rises to an elevation of 440 feet (134^m1) on its western side; there is a village near the southern point of the island.

20 An extensive bank, on which the depths are less than 3 fathoms (5^m5), extends about 6½ miles north-north-westward from the north-western point of Kisseraing island. Square rock, 15 feet (4^m6) high, lies at the extremity of this bank, about 2 miles east-south-eastward of the eastern extremity of Trotter island. Quoin rock, 30 feet (9^m1) 25 high, lies about three-quarters of a mile southward of Square rock; there is a growth of jungle on both Square and Quoin rocks. Sidney island, 70 feet (21^m3) high, small and thickly wooded, lies about half a mile northward of the northern point of Julian island and marks the southern side of the channel leading between Julian and Kennedy 30 islands.

Kennedy island, 570 feet (173^m7) high and densely wooded, lies about one mile eastward of Julian island. Numerous rocks and islets lie between it and the southern end of Sellore island, and a shoal, with a depth of 4½ fathoms (7^m8) over it, lies between it and Julian 35 island. Rocks extend about 2 cables from the south-eastern point of the island.

Tucker island lies close eastward of Kennedy island, being separated from it by a channel about one cable wide; it is densely wooded and has two peaks, 730 and 692 feet (222^m5 and 210^m9) high, respectively.

40 Kanmaw, where there is a large fishing village, is situated at the north-eastern end of Kisseraing island, about 2 miles south-eastward of Tucker island. A rock, situated about a quarter of a mile north-eastward of Kanmaw, is marked by a beacon. There is regular sea communication between Kanmaw and Mergui (page 435).

45 **Leslie's Garden.—Celerity passage.**—An extensive flat, which dries in patches, extends north-westward for about 5½ miles from the north-western end of Kisseraing island to within about half a mile of Jack island (*Lat.* 11° 51' N., *Long.* 98° 18' E.), and also extends westward for about 4½ miles from the same point to within a short 50 distance of the eastern coast of Domel island. That part of the flat which lies westward of the north-western end of Kisseraing island is called Leslie's Garden.

Celerity passage is a narrow channel leading from southward into the south-western corner of Morrison bay between the western edge

Chart 216a.

of Leslie's Garden and the coast of Domel island ; it is very tortuous and is only from one to 2 cables wide.

Southern approach to Morrison bay.—Islands and dangers.—

Anchorage.—The southern approach to Morrison bay is entered 5 between the south-eastern point of Domel island and Maw-yut, the southern extremity of Kisseraing island, about 15 miles east-north-eastward. The western side of Kisseraing island is fronted by a bank which, with depths of less than 3 fathoms (5^m5), extends as much as 4 miles offshore at a position about 11 miles west-north-westward 10 of Maw-yut (*Lat.* 11° 31' N., *Long* 98° 31' E.).

Chart 3051.

The Marble isles are a group of two large and four smaller islands, lying between 3½ and 7 miles north-north-eastward of the south-eastern point of Domel island and about 1½ miles from the eastern 15 coast of that island. Hngetthaik taung, the largest and highest of these islands, is 1,038 feet (316^m4) high, and lies near the southern end of the group. The islands are rocky, precipitous and steep-to and are practically bare of trees ; they afford good anchorage in either monsoon, the greater depths being between them and the coast 20 of Domel island.

At the southern end of Hngetthaik taung there is a cove, from the head of which a winding tunnel, 150 yards (137^m2) long, leads at low water under the cliff into a lagoon which is open to the sky but is entirely surrounded by vertical cliffs about 400 feet (121^m9) high. 25 Opening out of this lagoon are two caves, one extending for about 200 yards (182^m9) into the heart of the mountain and forming a breeding place for the sea-swallow, whose edible nests are regularly collected ; the other cave is smaller but of most attractive appearance, showing wonderful stalagmite and stalagmite formations. The usual 30 anchorage here is off the western entrance point of the cove, in a depth of 6 fathoms (11^m0).

There are no permanent inhabitants on the Marble isles. In 1931, it was reported by H.M.S. *Effingham* that good fishing could be obtained 35 around the group.

Sydney island, an islet 125 feet (38^m1) high, lies close southward of the south-western extremity of Kisseraing island, about 5½ miles west-north-westward of Maw-yut, and is wooded and brown in appearance ; rocky ledges extend about 2 cables north-eastward and south-westward from it. Laila Rook (Lalla Rookh) island or Leik-u-daung 40 lies about 2 miles westward of Maw-yut and is well-wooded with a prominent dark tree on its northern end. Laila Rook island is the southernmost of a group of islets which include Pillam, Tango, and Pitt islands ; all these islets are thickly wooded and fringed with reef and the area between them and the coast of Kisseraing island is foul 45 with numerous drying patches.

Charts 3051, 216a.

Directions.—Beacons.—The tidal streams are not strong, but vessels should only use Celerity passage on the last of the flood.

Vessels approaching from northward should steer to pass close eastward of Una and Jack islands, passing about 2 cables from the latter and should then work over to the coast of Money island, where there are the greatest depths. When the eastern point of Money island is passed, course should be shaped 180° for about one mile, and then

Charts 3051, 216a.

158°, keeping Pagoda point (*Lat. 11° 48' N., Long. 98° 18' E.*), near the northern end of Domel island, well open of the rock 6 cables northward of it. When the north point of Domel island bears 271°, course 5 should be shaped to pass Pagoda point at a distance of about one cable, whence a mid-channel course should be kept between Leslie's Garden, eastward, and two rocky points on the north-eastern side of Domel island, westward.

Chart 3051.

10 Farther southward the channel is marked by white beacons.

After passing beacon No. III, which is surmounted by a cone, course should be shaped 180° until deep water is reached. The channel is well marked by discoloration.

- When Hingetthaik taung bears 270°, about 1½ miles distant, vessels 15 proceeding through Forrest strait should steer for a position 2½ miles eastward of Haldane island. Thence a course of 180° should be made good until High island, about 14 miles southward, bears 270°, distant 2½ miles, when course should be altered to 174°, which leads clear of all dangers into the eastern channel of Forrest strait (*see* page 465).
- 20 Deep draught vessels wishing to use the western channel of Forrest strait should, when High island bears 270°, distant 2½ miles, make good a course of 195°, until the southern end of the southern Dolphin island bears 270°, when course should be altered to 180°.

Chart 216a.

- 25 **WHALE BAY AND APPROACHES.—General remarks.—**Whale bay lies between the southern part of the eastern side of Kisseraing island and the mainland eastward, the approach to it being from south-westward. The entrance lies between Maw-yut point and Wet kyun, about 9 miles eastward, and good anchorage, in depths 30 of from 6 to 10 fathoms (11^m0 to 18^m3), may be obtained in the southern part of the bay, but caution is necessary as the bay and its vicinity have only been partly examined.

Chart 3051.

- Islands and dangers in the approaches.**—Pawē kyun lies about 35 3¼ miles south-south-westward of Maw-yut point (*Lat. 11° 31' N., Long. 98° 31' E.*); a prominent hill, 681 feet (207^m6) high and covered with trees, stands near the southern extremity of the island. A reef, on which is Firth rock, extends half a mile north-eastward from the north-eastern side of Pawē kyun and depths of less than 3 fathoms 40 (5^m5) extend more than a mile farther north-eastward. Vera island, which is 295 feet (89^m9) high, and well wooded, lies about 1½ miles north-eastward of the northern point of Pawē kyun. Vera shoal, with a depth of 39 feet (11^m9), lies nearly in mid-channel between Vera island and Laila Rook island; there are considerable depths 45 between Vera island and Maw-yut point, and numerous tide-rips. Robert island, densely wooded and 230 feet (70^m1) high, lies southward of the southern point of Pawē kyun, being separated from it by a narrow channel. There is a shoal, with a least depth of 10 feet (3^m0), lying about one mile off the south-eastern side of Pawē kyun.
- 50 Fink island, densely wooded and 270 feet (82^m3) high, lies about 2½ miles south-westward of Robert island, and is the north-eastern-most of a group of small islands and rocks, amongst which are Molly island, densely wooded, rather flat and 120 feet (36^m6) high, Ruby

Charts 216a, 830, 70.

Chart 3051.

island, 140 feet (42^m7) high, and Lawrence island, 265 feet (80^m8) high. Vessels should not use the channels between these islands on account of the tide-rips and varying currents.

Malcolm island, densely wooded, lies about 5½ miles southward of Pawē kyun. The centre of the island is low, Ale-Hmān, the highest peak, 901 feet (274^m6) high, being near the southern end. Depths of less than 3 fathoms (5^m5), with some drying patches, extend about 2 miles south-westward from its western side; this bank is generally well marked by discoloration, especially during the ebb tide. Alice island, 104 feet (31^m7) high and densely wooded, lies near the north-eastern end of a shoal, with depths of less than 3 fathoms (5^m5) over it, which lies about 2 miles north-westward of the northern point of Malcolm island. Barn island, 375 feet (114^m3) high and densely wooded, lies about 4½ miles westward of the southern part of Malcolm island.

Cheding flats extend north-eastward from Malcolm island to the mainland just southward of the entrance to Yengan chaung. Warrington reef is an isolated patch, which dries 5 feet (1^m5), lying on Cheding flats, about 7½ miles north-eastward of Malcolm island.

There is an ill-defined channel across Cheding flats which is about 1½ miles wide with a least depth of 7 feet (2^m1). Vessels using this channel should approach with the summit of Wet kyun bearing 023°, passing about 1½ miles south-eastward of the south-eastern coast of Malcolm island; when the northern end of Laila Rook island is just open south-westward of the southern end of Vera island, bearing 320°, it should be kept on that bearing which leads to the main entrance channel, east-south-eastward of Pawē kyun.

Charts 3051, 216a.

Whale bay.—Islands and dangers.—Maw-yut point (Lat. 11° 31' N., Long. 98° 31' E.), the western entrance point of Whale bay, is steep-to on its southern and eastern sides. Wet kyun, on the eastern side of the entrance, is 410 feet (125^m0) high and well wooded; there is no navigable channel between it and the mainland about 4 miles eastward. Kyauk-kalat, a small islet, 52 feet (15^m8) high, and of whitish appearance, lies about half a mile southward of Wet kyun and on the northern side of the entrance to Yengan chaung, a creek with flats which dry fronting both banks at its mouth.

From the entrance to Yengan chaung, the eastern side of Whale bay trends northward for about 14 miles to the mouth of Lenya river at the north-eastern corner of the bay, and is fringed with mangroves and intersected by creeks, none of which is as large as Yengan chaung.

On the western side of the bay, Campbell rock, awash, and marked by a beacon surmounted by a white circle, lies about 3 miles north-eastward of Maw-yut point; Campbell rock has two pinnacles, is steep-to on its eastern side and is apparently of small extent.

Mawgaung-dôn, a projection on the western shore of the bay, lies about 6 miles northward of Maw-yut point; for about 3 miles southward of Mawgaung-dôn, the coast is fronted by Bhadra reef which extends as much as 1½ miles offshore. In 1912, the S.S. *Bhadra*, having a draught of 8 feet (2^m4), struck a rock on the outer part of the reef, about 1½ miles southward of Mawgaung-dôn.

Northward of Mawgaung-dôn the depths decrease and a channel which runs northward along the eastern side of Kisseraing island, nearly dries.

Charts 830, 70.

Chart 830.

Lenya river rises close to Pakchan river (page 475) and flows roughly from south to north. At Lenya village, which is situated about 36 miles above the entrance, the river is not more than one cable in width, and is navigable by small power vessels which have ascended to this point.

*Chart 3051.***YENGAN CHAUNG ENTRANCE TO KARATHURI BAY.—**

Coast.—Islands and dangers.—From the southern entrance point of Yengan chaung, situated about 3 miles south-eastward of Kyaukkalat, the coast trends southward for about 11 miles to the entrance to Bokpyin chaung and for nearly the whole distance is fringed with mangroves and intersected by creeks.

Sadein Ondawgan, the largest of many villages in this locality, is situated on the coast about 5 miles southward of the southern entrance point of Yengan chaung; Cheding rocks, 40 feet (12^m2) high, lie close offshore about 1½ miles north-westward of Sadein Ondawgan.

Khogyun, an island 215 feet (65^m5) high, about 5½ miles south-south-westward of Sadein Ondawgan, is well wooded and forms a good mark for making Bokpyin chaung. A shoal, with small rocky patches which dry about 4 feet (1^m2), extends about half a mile north-eastward from Khogyun. Boat rock, 50 feet (15^m2) high, lies about 8 cables northward of Khogyun and a spit extends about 4 cables north-north-eastward of the rock. Bhadra rock, which dries 3 feet (0^m9), lies about 1½ miles north-westward of Khogyun (*Lat.* 11° 17' N., *Long.* 98° 41' E.).

Charts 3051, 216a.

Bokpyin chaung.—Anchorage.—Bokpyin chaung is a small stream, flowing between mudbanks which nearly dry; it is marked by beacons as far as the village, but is only navigable by boats. The entrance lies between drying mud flats and, in 1945, there was a depth of 2 feet (0^m6) over the bar at low water.

Anchorage for small vessels can be obtained off Bokpyin chaung, in a depth of 4 fathoms (7^m3), about one mile southward of Khogyun.

The village, which is mostly built on piles, is on the southern side of the creek, at the entrance; the District Police Officer's house, situated on a hill above the village, is prominent. Sand and mud flats dry out over 2 miles from the village, on both sides of the channel.

Chart 3051.

There is regular sea communication with Mergui.

Bokpyin chaung entrance to Karathuri bay.—Coast.—Off-lying islands and dangers.—Between the entrance to Bokpyin chaung and a point abreast the islands forming the northern side of Karathuri bay, about 13 miles southward, the coast is much indented by creeks and streams and is backed by hills. Nopu Taung Saba, 158 feet (48^m1) high and prominent, lies about 4½ miles south-westward of Khogyun; it is the north-westernmost islet of a group of islets and rocks on the southern side of the approach to Bokpyin chaung, and vessels should not enter the area between these islets and the mainland where there are many rocks and reefs. Needle rocks lie about 1½ miles north-eastward of Nopu Taung Saba.

Pulau Ting-nga are three conical rocks, the southernmost and highest being 70 feet (21^m3) high, which lie about 1½ miles southward of Nopu Taung Saba; foul ground lies within 1½ miles north-east-

Charts 216a, 830, 70.

Chart 3051.

ward and three-quarters of a mile eastward of Pulau Ting-nga. Pulau Ampat are three well-wooded islets, the southernmost of which is 250 feet (76^m2) high, situated about 3½ miles south-south-westward of Nopu Taung Saba, which appear from a distance as one; foul ground extends about 1½ miles east-north-eastward. North Cone islet, 99 feet (30^m1) high, lies about 2 miles south-westward of Pulau Ampat; Pulau Kyin Ngai, 228 feet (69^m5) high, lies about 4 miles west-south-westward of North Cone islet; and Pulau Panyam, 240 feet (73^m1) high, lies about 3 miles farther south-westward.

Karathuri bay.—Entrances.—Karathuri bay lies between Carnac and Jenkins islands on the north, and Kyeinni taung and The Brothers islands on the south. Carnac and Jenkins islands are surrounded by numerous islets all lying on an extensive mudbank about 6 miles south-south-eastward of North Cone islet, which is separated from the mainland by a narrow channel.

Hangapru village, situated on the northern side of the head of the bay and Karathuri village, about 5 miles farther southward, are inhabited entirely by Chinese. Kyauktanaung chaung flows into the southern side of the bay about 6 miles westward of Karathuri village, and Kyanmi chaung enters the bay about 2½ miles farther westward; a deserted village stands on the banks of the former creek.

Carnac channel leads into Karathuri bay from northward between Carnac island and Kau ye kyun, about 3 miles westward. On the western side of Carnac channel, from north to south, are Pulau Balat, Pulau Bagang and Gertrude (Gerty) island; on the eastern side are Pulau Dana (North Sister), Pulau Kapang (Middle Sister), Pulau Tokadin (South Sister), Wing rocks, South Cone islet, Pulau Kamat and Pulau Bucho.

Warrington straits lead into Karathuri bay from westward, between Collies island and Kau ye kyun on the north, and Mingyi Sakan, Sir Robert Campbell island and Kandaw (Alice island) on the south; Kyaukme-daung (Van island) with Tunnel rock (*Lat.* 10° 54' N., *Long.* 98° 32' E.), which is conspicuous, lie close northward of Kandaw.

Riou island, 215 feet (65^m5) high, lies at the western end of Warrington straits, about 1½ miles southward of Collies island, from which it is separated by Warrington passage. Foul ground extends about 4 cables north-eastward from Riou island.

Kinnear's passage separates Collies island from the southern part of Kau ye kyun; the western coast of the latter island is foul and should not be approached within a depth of 4 fathoms (7^m3).

There is regular sea communication between Karathuri bay and Mergui.

FORREST PASSAGE.—The entrance to Forrest passage from seaward lies between Father island (page 449) and Clara island, about 17 miles south-south-westward.

Clara island has two peaks; the northern peak, 1,753 feet (534^m3) high, is the higher and the southern peak is the sharper. North Sentinel islet, which has a rock close off its western side, lies about 1½ miles north-eastward of the north-eastern point of Clara island, and South Sentinel islet lies about half a mile south-south-westward of the southern end of the same island. Kanzagyi (Farquhar island), 568 feet (173^m1) high, lies about 2¾ miles eastward of Clara island

Charts 216a, 830, 70.

Chart 3051.

and about one mile farther eastward is Wa-Ale kyun (Blunt island). Close north-eastward of Wa-Ale kyun is the south-western extremity of Lampi island, *see* below.

- 5 **Tidal streams.**—In Forrest passage the tidal streams set eastward with the rising tide and westward with the falling tide, at a rate of about $2\frac{1}{2}$ knots at springs.

FORREST STRAIT.—**General remarks.**—Forrest strait, the northern entrance to which lies between the northern end of Lampi island and Collies island, about 15 miles eastward, is the continuation southward of Bentinck route and extends about 70 miles southward as far as the entrance to Pakchan river between the mainland coast and a chain of islands, islets and rocks from about 10 to 12 miles offshore. About 18 miles southward of the northern entrance to the
15 strait, a group of islands lies in the fairway and divides the strait into two channels. The track through the strait passes through discoloured water and, in its northern part, the recommended track is indicated by pecked lines on charts 3051 and 216a.

Tidal streams.—In the northern approaches and entrance, between
20 Bernard island and Dolphin islands, the tidal streams set east-north-eastward with the rising and west-south-westward with the falling tide, with rates at springs of about $1\frac{1}{2}$ knots. Overfalls and eddies occur about 2 miles westward of High island.

Inside the strait, the tidal streams set northward with the rising
25 and southward with the falling tide, with rates at springs of about one knot. In the vicinity of the channels between the islands on the western side of the strait, the directions are north-eastward on the rising and south-westward on the falling tide, with rates of from $1\frac{1}{2}$ to $1\frac{1}{2}$ knots at springs.

30 **Northern entrance.—Islands and dangers.—Anchorage.**—Two Hill island, 470 feet (143^m3) high, lies about 3 cables eastward of the northern point of Lampi island, and Pulau Gaban or Olive island, 395 feet (120^m4) high, lies about one mile farther east-south-eastward; a rock, awash, lies about a quarter of a mile north-west-
35 ward of Pulau Gaban.

High island (*Lat.* $11^\circ 01' N.$, *Long.* $98^\circ 18' E.$), situated in the middle of the northern entrance to Forrest strait, about 7 miles east-north-eastward of the northern point of Lampi island, has twin peaks, the higher of which has an elevation of 1,405 feet (428^m2). A rocky
40 ledge, which dries, extends about 2 cables from a sandy beach on the south-eastern side of the island, and close westward of the ledge is a cove.

Anchorage, in a depth of about 12 fathoms (21^m9), may be obtained off the cove and close inshore. Overfalls and tide-rips are numerous
45 in the vicinity of High island.

Collies island, the eastern entrance point of the strait, about 7 miles east-south-eastward of High island, is about 450 feet (137^m2) high.

Northern part of Forrest strait.—Islands and dangers.—
50 **Beacons.**—The eastern coast of Lampi island, forms the western side of Forrest strait for about 19 miles south-south-eastward of the entrance. The island rises steeply on its eastern side, forming a thickly wooded range of hills about 1,000 feet (304^m8) high, of which

Charts 216a, 830, 70.

Chart 3051.

East peak, 1,515 feet (461^m8) high, about 12 miles south-south-eastward of the northern extremity of the island, is the highest.

Dolphin islands, three densely wooded islets, are situated between 3 and 5½ miles south-south-eastward of Pulau Gaban and about one mile offshore; the southernmost islet, 260 feet (79^m3) high, is the highest. Between Lampi island and the Dolphin group there is a channel about 6 cables wide, with a least depth of 4 fathoms (7^m3), mud, which affords anchorage for several craft. Katyang, an island, 225 feet (68^m6) high, about 2 miles southward of the Dolphin islands, lies close to the coast, with which it is connected at low water by a sand causeway.

Southward of Collies island, the eastern side of the strait is formed by Riou, Mingyi Sakan, and Sir Robert Campbell islands for about 12 miles, and thence by the mainland coast of the Tenasserim district of Burma. Warrington passage, lying between Collies and Riou islands, leads into Warrington straits, and these straits, lying between Riou island and Mingyi Sakan, lead into Karathuri bay, which is described on page 459.

Half Moon reef, lying about 1½ miles off the western shore of the strait, about 2½ miles south-eastward of Katyang, dries one foot (0^m3); about midway between this reef and Katyang, there is a smaller coral reef on the edge of the coastal bank which also dries one foot (0^m3). The summit of Pulau Gaban, bearing about 320° and well open north-eastward of the northernmost Dolphin island, leads eastward of Half Moon reef as also does Bold promontory, *see* below, bearing 190° and open eastward of The Foreland, a headland about 3½ miles southward of the reef.

Shitpwin kyun, 90 feet (27^m4) high, about 7½ miles eastward of Half Moon reef, is the northernmost of several islets and rocks which lie on a coastal bank on the eastern side of Forrest strait. A rock which just dries lies about 3 cables northward of Shitpwin kyun, and is marked by a beacon surmounted by a white ball at an elevation of 14 feet (4^m3). Campbell reef, a flat, rocky reef, the south-western end of which lies about 3½ miles southward of Shitpwin kyun, dries about 8 feet (2^m4); a beacon, surmounted by a white ball at an elevation of 20 feet (6^m1), marks the south-western end of Campbell reef.

Jefford shoal, with a depth of 5 fathoms (9^m1), sand, and steep-to, lies near the middle of the strait about 4½ miles west-south-westward of Shitpwin kyun.

The Foreland, a headland, 435 feet (132^m6) high, forms the eastern extremity of Lampi island and is more prominent than Bold promontory, about 2½ miles farther southward and about 280 feet (85^m3) high.

Marble island (*Lat.* 10° 46' N., *Long.* 98° 18' E.), 270 feet (82^m3) high, with an islet close westward of it, lies about one mile south-south-westward of the southern side of The Foreland, with Bulet-aw, a bay which is shoal, between them. A shoal, with a depth of 7½ fathoms (13^m7) over it, lies in the middle of the strait, about 3½ miles eastward of The Foreland. Ranson shoal, over which there is a least depth of 4 fathoms (7^m3), coral, lies about 2½ miles southward of Bold promontory and about 2 miles eastward of the southern end of Lampi island.

Charts 216a, 830, 70.

Chart 3051.

Pinwun maw, situated about 3 miles east-south-eastward of Campbell reef beacon, is the north-western point of that part of the Tenasserim district of the mainland which forms the eastern side of the strait ;
 5 from this point, the coast trends southward for about $7\frac{1}{2}$ miles to Tutthabo maw. These two points and Kyakaik maw, about midway between them, are the only prominent marks along this stretch of coast, which is low although high at some distance inland. Kala taung, a hill, 770 feet (234^m7) high, situated about $1\frac{1}{4}$ miles south-eastward
 10 of Kyakaik maw, is the highest hill near the coast ; about $1\frac{1}{4}$ miles southward of it is a smaller hill, 435 feet (132^m6) high. This stretch of coast is fringed by a mudbank on which are numerous rocky patches which dry, lying about half a mile offshore.

Gregory group consists of five low, wooded islands on flat, rocky
 15 bases, covered with sand, lying in the middle of Forrest strait and extending about 7 miles southward from a position about 4 miles east-south-eastward of Bold promontory. The group is uninhabited but is visited by woodcutters. The Nicobar pigeon, flying fox, monitor lizard and the tree crab are found on the islands. Leik-u-kyun, the
 20 northernmost of the group, is a mere wooded cay, 108 feet (32^m9) high ; shoals extend about $1\frac{1}{2}$ miles northward from it, terminating in Marble patch, which has a least depth of 6 feet (1^m8), sand and shell.

Wa kyun, Pulau Myang and Pulau Myang Basa, 175, 160 and 235 feet (53^m3 , 48^m8 , and 71^m6) high, respectively, all lie within $3\frac{1}{2}$ miles
 25 southward of Leik-u-kyun ; extensive coral reefs surround these islands, with a deep gut about 4 cables wide, between Pulau Myang and Pulau Myang Basa.

Myang shoal, with a least depth of 6 fathoms (11^m0), sand, lies about $1\frac{1}{4}$ miles west-south-westward of Pulau Myang, and Karachi
 30 rock, which dries one foot (0^m3), lies about $1\frac{1}{2}$ miles south-eastward of Pulau Myang Basa and is marked by a beacon surmounted by a white ball, at an elevation of 17 feet (5^m2).

Pulau Tuhan or Boyut island, 195 feet (59^m4) high, and the southernmost of the Gregory group, lies about 2 miles southward of Pulau
 35 Myang Basa, with a least depth of 9 fathoms (16^m5) in the fairway of the channel between them which is about $1\frac{1}{4}$ miles wide ; a shoal ridge extends about half a mile south-westward of Pulau Tuhan.

Pulau Nala and Pulau Kugyi, 770 and 440 feet (234^m7 and 134^m1) high, respectively, lie within a distance of $4\frac{1}{2}$ miles southward of
 40 Lampi island, with several islets between them and form the western side of the strait. Steep shoal, with a least depth of 5 feet (1^m5), rock, lies about $1\frac{1}{4}$ miles eastward of the northern point of Pulau Kugyi. The Foreland, bearing about 000° and well open eastward of Bold promontory, leads eastward of Steep shoal.

45 Pulau Tu-ante (*Lat. $10^\circ 40' N.$, Long. $98^\circ 12' E.$*), 282 feet (85^m9) high, lies about $2\frac{1}{4}$ miles westward of the south-western point of Pulau Nala. An area of foul ground with numerous sunken rocks extends about 2 miles north-north-westward of Pulau Tu-ante ; Observation island, 140 feet (42^m7) high, lies nearly in the middle of
 50 this foul ground. Pulau Labiaung, 335 feet (102^m1) high, lies about three-quarters of a mile westward of Pulau Kugyi.

Southern part of Forrest strait.—Islands and dangers.—Anchorages.—Pulau Hayat and Saucer island, 289 and 280 feet (88^m1 and 85^m3) high, respectively, lie close together about 2 miles

Charts 216a, 830, 70.

Chart 3051.

south-south-westward of Pulau Kugyi, and Pulau Balu lies about one mile farther south-south-westward. Pulau Bada (Buda) lies about one mile south-south-westward of Pulau Balu and has an elevation of 1,151 feet (350^m8) near its southern end. An unexamined area, in which lie Pocock island and five islets, extends as much as 4½ miles southward and south-westward from the southern side of Pulau Bada; the southernmost islet of the group has foul ground extending from its southern side.

Bowen shoal, consisting of white sand and coral, lies about one mile eastward of the south-eastern point of Pulau Bada and dries 2 feet (0^m6); a shoal ridge with a least depth of one foot (0^m3) lies between one and 2 miles northward of Bowen shoal and about one mile from the eastern side of Pulau Bada. Another shoal with a least depth of 23 feet (7^m0) lies about 3½ miles eastward of the north-eastern point of Pulau Bada.

Between Pulau Bada and Pine Tree island, 205 feet (62^m5) high, about 10 miles south-south-eastward, is a chain of islands and islets, including Potter and Saddle islands, Naked and Bare islets, Ninepins and Cat and Kitten island; all these islands lie on the western side of the strait and should be approached with great caution as the bottom around them is very rocky and the depths are irregular. North-west Hump island, 400 feet (121^m9) high, lies about 4 miles westward of Cat and Kitten island.

A reef, on which are several drying rocks, extends about 1½ miles northward from the northern coast of Pine Tree island. Good anchorage, in a depth of 10 fathoms (18^m3), may be obtained off the north-eastern side of the island, with its summit bearing 231°, distant 6 cables. Care should be taken to avoid the reef, mentioned above.

From Tutthabo maw (page 462), the eastern shore of the strait trends southward for about 26 miles to a point close off which is Pulau Mah Puteh. Turrets islands, a group of three islets, lie about 6 miles southward of Tutthabo maw and about 2½ miles offshore. Pulau Salāngin, the middle and largest island of the group, is a bold, precipitous rock, 341 feet (103^m9) high, which in clear weather stands out like a square block from the mainland; Pulau Beba lies close northward, and Pulau Prewang about half a mile southward, of Pulau Salāngin. A 17-foot (5^m2) patch lies about 7 cables south-south-westward of Pulau Prewang.

An islet, 55 feet (16^m7) high, lies about 1½ miles south-south-eastward of Pulau Prewang and two rocks which dry 3 and 10 feet (0^m9 and 3^m0), respectively, lie close westward of it. Whaleback rock, 3 feet (0^m9) high, lies about 2½ miles southward of Pulau Prewang and about 2½ miles offshore. Canister island, 285 feet (86^m9) high, lies about 6 miles southward of Whaleback rock and about 4 miles offshore, and about 10 miles farther southward and about 4 cables off the eastern shore of the strait, is Pulau Mah Puteh which is 266 feet (81^m1) high.

South-east Hump (*Lat.* 10° 16' N., *Long.* 98° 19' E.), an islet 320 feet (97^m5) high, lies on the western side of Forrest strait about 4½ miles south-south-eastward of Pine Tree island; sunken rocks lie close north-westward and southward of the islet, and a rock, awash, lies about half a mile south-south-eastward of it. The Five Islands, five islets or rocks, the northernmost of which is 160 feet (48^m8) high and the most prominent, extend about 1½ miles northward from a

Chart 3051.

position about 2 miles eastward of South-east Hump; a rock, which dries 5 feet (1^m5), lies about a quarter of a mile north-westward of the northernmost of The Five Islands.

- 5 Russell island, covered with trees and jungle and with a well-defined summit, 875 feet (266^m7) high, lies on the western side of the strait, about 5 miles south-south-westward of Pine Tree islet. Two Tree island, 220 feet (67^m1) high, and covered with grass, lies about 6 cables northward of the north-western point of Russell island; a reef of
10 rocks lies close off its western point. The channel between Russell and Two Tree islands is narrow and is not recommended. Little Russell island, 250 feet (76^m2) high, and covered with trees, lies about 7 cables southward of Russell island with a rocky islet, 60 feet (18^m3) high, lying close off its south-western point; there are considerable
15 depths in the fairway of the passage between Russell and Little Russell islands, which is about 5 cables in width.

The currents around Little Russell island are uncertain in strength and direction and numerous eddies exist; vessels should therefore keep well clear of the rocky islet lying close south-westward of Little
20 Russell island.

North Phipps island, 360 feet (109^m7) high, lies about 3½ miles south-eastward of Little Russell island, and South Hump and Helmet islands lie about 5½ and 7 miles, respectively, east-south-eastward of the same island. Helmet island is surrounded by foul ground
25 which extends about one cable offshore.

St. Luke's island, a large irregularly-shaped island 1,970 feet (600^m5) high, lies with Bengal point, its north-eastern extremity, about 2 miles westward of North Phipps island. The channel between Little Russell island and the northern end of St. Luke's island is about 2 miles wide
30 and is clear of dangers, but vessels should avoid a 32-foot (9^m8) rocky patch, which lies about 1½ miles east-north-eastward of the north-western extremity of St. Luke's island and about half-a mile offshore.

South Phipps, Barwell and Horseshoe islands lie on the western side of the strait, between 2 and 4 miles south-south-westward of
35 Helmet island and close off the north-eastern and eastern coasts of Hastings island. There is a channel about one cable wide, with a depth of 3 fathoms (5^m5), between South Phipps and Barwell island, and boat channels with a depth of about 10 feet (3^m0) at high water, between South Phipps and Hastings islands and between Horseshoe
40 and Hastings islands.

Most of the islands mentioned above, with the exception of South Hump and those forming Hastings harbour, are covered with trees and jungle and generally have well-defined peaks, especially South Hump island (*Lat.* 10° 11' N., *Long.* 98° 20' E.) and the northern summit
45 on Hastings island which is 875 feet (266^m7) high.

Hastings harbour and Hastings, St. Luke's and St. Matthew's islands which shelter it, together with the adjacent islands and islets, are described on page 468.

On the eastern side of the strait between Pulau Mah Puteh and
50 Victoria point, the northern entrance point of Pakchan river, about 14 miles south-south-westward, the coast is fronted by an extensive bank which, with depths of less than 3 fathoms (5^m5), extends south-south-westward, the distance offshore of its outer edge increasing from about 1½ miles abreast Pulau Mah Puteh to about 11 miles

Chart 3051.

abreast Victoria point. There are several patches of less than 6 feet (1^m8) on this bank and there is a one-fathom (1^m8) patch on its outer edge about 11 miles westward of Victoria point. The islands and dangers lying on the southern part of this bank in the approach to Pakchan river are described on page 472. 5

Anchorage in Forrest strait.—Anchorage, in depths of from 7 to 8 fathoms (12^m8 to 14^m6), may be obtained eastward of Pulau Gaban and south-south-westward of High island, in the position indicated on the chart. Good anchorage may be obtained almost anywhere on the eastern side of the strait, off the mainland between High island and Turrets islands, in depths of 5 or 6 fathoms (9^m1 or 11^m0), with good holding ground of soft mud. 10

Directions for Forrest strait.—Forrest strait is used by all power vessels and native craft trading through the archipelago; the depths in it are considerable and good shelter may be obtained from westerly winds. Strangers should navigate with caution when using the strait at night, and the western rather than the eastern channel should be used, as the Gregory group can be passed within one mile in deep water and the ship's position fixed. 15 20

Western channel.—From a position about 2 miles south-westward of High island (*see* page 460) vessels should continue to make good a course of 152° until the southern extremity of the southern Dolphin island (*Lat.* 10° 54' N., *Long.* 98° 16' E.) bears 270°, distant about 4 miles, when course should be altered to 180°, and maintained until Bold promontory bears 270°, distant about 1½ miles; course should then be shaped about 186° until Pulau Tuhan bears 090°, distant 2 miles, when course may be altered to 165° for a position 2 miles eastward of the Five Islands; thence course should be shaped about 193°, to clear the extensive sand and mud flat lying off Pakchan river entrance; or, if bound for Pakchan river, when abreast of Pulau Mah Puteh, proceed as directed at page 475. 25 30

Eastern channel.—From a position about 2 miles south-westward of High island vessels should continue to make good about 152° until Shitpwin kyun bears about 045° when course should be altered to about 172°, which leads in mid-channel in a least depth of 4½ fathoms (8^m2), until Karachi beacon bears 270°, distant about one mile, when course should be altered to about 181° to pass about 2 miles eastward of the Five Islands, then proceed as directed for the western channel. 35

ISLANDS AND BANKS WESTWARD AND SOUTH-WESTWARD OF FORREST STRAIT.—**Passages.**—**Anchorage.**—North Twin and South Twin are the outermost of the islands lying westward of Forrest strait. North Twin, which is about 450 feet (137^m2) high, is situated about 16 miles south-westward of Clara island (page 459); its northern and eastern sides are densely wooded but its western side is bare to an elevation of about 100 feet (30^m5). 40 45

South Twin lies about 9½ miles southward of North Twin and is about 270 feet (82^m3) high; its western side is almost bare and at its summit is a prominent expanse of bare rock. There is a bay with a sandy beach on both its northern and southern sides, but they afford little shelter; there are two rocks close off the north-western point of the island. A sunken rock is charted close north-eastward of the eastern extremity of the island. 50

Chart 3051.

Great Swinton islands lie about 17 miles south-south-eastward of Clara island and about 15 miles east-south-eastward of North Twin. Between Wa-alē kyun (Blunt island) (page 460) and Kyun Pila, the westernmost island of the Great Swinton group, about 15 miles south-south-westward, are the following islets. Pulau Tika, 299 feet (91^m1) high, about 3 miles south-south-westward of the southern extremity of Wa-alē kyun; Brown island, 100 feet (30^m5) high, and Pulau Tajam, 155 feet (47^m2) high, about 2 and 3½ miles, respectively, south-south-westward of Pulau Tika; and an unnamed islet with a sunken rock close westward of it, situated about 5½ miles south-westward of Pulau Tajam and about 3 miles north-westward of the northern point of Kyun Pila.

A group of white rocks, 10 feet (3^m0) high, lies about three-quarters of a mile south-south-eastward of the eastern extremity of Kyun Pila. Pulau Set, the easternmost of the Great Swinton group, 681 feet (207^m6) high, lies about 3½ miles eastward of Kyun Pila; a rocky islet, 96 feet (29^m3) high, surrounded by sunken rocks, lies about 1½ miles south-westward of Pulau Set, and another rocky islet, also surrounded by sunken rocks, lies about 3½ miles south-south-eastward of the same island.

Loughborough island, the western coast of which is bold, steep-to and densely wooded, lies about 3¾ miles south-westward of Kyun Pila; there are several peaks on the island, the most prominent of which are The Paps, about 1,440 feet (438^m9) high, situated on its eastern side.

Loughborough passage lies between Kyun Pila and Loughborough island. A rock, with a depth of 2 fathoms (3^m7) over it, lies in the middle of the western entrance to the passage, about 1½ miles south-south-westward of the western extremity of Kyun Pila (*Lat.* 10° 33' N., *Long.* 97° 57' E.). Pollock reef, with a rock 50 feet (15^m2) high near its south-western end, and another rock, 12 feet (3^m7) high, near its north-eastern end, lies at the eastern end of the passage. Vessels should not use Loughborough passage.

Hayward island, with sunken rocks extending about half a mile north-eastward from it, lies about half a mile north-eastward of the eastern extremity of Loughborough island, and Richards island lies about three-quarters of a mile south-eastward of the same point. Good anchorage may be obtained, in depths of from 8 to 15 fathoms (14^m6 to 27^m4), mud, between Richards island and Loughborough island, and there are depths of 3 fathoms (5^m5) close to either coast.

O'Connor, Saul and Skinner islands lie between one and 2 miles north-eastward of Richards island; it is reported that there are off-lying rocks around them and, if passing between them and Richards island, vessels should keep nearer the Richards island side.

Cavern island, 865 feet (263^m7) high, lies about 5 miles south-eastward of Loughborough island, with Stewart and McCarthy islands, 505 and 700 feet (153^m9 and 213^m4) high, respectively, in the passage between them. There are several caverns, where edible birds' nests are obtained, in the southern part of Cavern island. Prominent rocks lie off the southern ends of all three of these islands.

Quoin island, 375 feet (114^m3) high, lies about 4 miles eastward of Cavern island, and High rock, 65 feet (19^m8) high, lies about 3 cables southward of Quoin island.

Charts 216a, 830, 70.

Chart 3051.

Investigator channel lies between McCarthy, Stewart and Cavern islands on the north, and St. Andrew's group, *see* below, on the south. It is about 6 miles wide and clear of dangers and vessels from westward bound for Hastings harbour (page 468) and Pakchan river can navigate it with safety. 5

Chart 830.

Three banks, which are steep-to but of which little is known, lie in the western approach to Investigator channel. Heckford bank, the north-easternmost, lies about 48 miles westward of Cavern island 10 with a depth of 7 fathoms (12^m8) over it; Coral bank, with a depth of 11 fathoms (20^m1), and Roe bank, with a depth of 8 fathoms (14^m6), lie about 49 and 81 miles, respectively, west-south-westward of Cavern island.

Chart 3051.

15

St. Andrew's group consists of a large number of densely wooded islands and rocks, those which can be identified from Investigator channel being Horsburgh island, 250 feet (76^m2) high, the westernmost of the group, situated about 9½ miles south-westward of Cavern island, with Horsburgh islet, 225 feet (68^m6) high, about 4 cables south-south-eastward, and Boulder rock, 25 feet (7^m6) high, about 8 cables south-westward of it; the four Cockburn islands, the highest of which is 535 feet (163^m1) high, situated about 5 miles eastward of Horsburgh island; Mackay island, 610 feet (185^m9) and Macleod island, 1,080 feet (329^m2) high, about 3 miles south-westward, and 1½ miles southward, 25 respectively, of the highest Cockburn island; and Parsons island, about 2½ miles east-north-eastward of Macleod island, with several islets and rocks close southward and eastward of it.

Parsons rock, a compact group of pinnacles which dry 6 feet (1^m8), lies about 1½ miles north-north-westward of the northern part of 30 Parsons island.

Mackenzie, Macbride, MacIan and MacNab islands lie about 3 miles southward of the main body of St. Andrew's group; Mackenzie island, the largest and highest of this group, is 810 feet (246^m9) high.

St. Paul's island with Rhinoceros Horn peak (*Lat.* 10° 09' N., 35 *Long.* 98° 09' E.), which is 735 feet (224^m0) high and prominent, is situated about 5½ miles eastward of Parsons island and close westward of the northern part of St. Luke's island (page 464), with a passage about 3 cables wide between them; the channel through this passage is narrow and fringed with coral, and there is a depth of 2 fathoms (3^m7) 40 near its northern end. The western side of St. Paul's island is foul, with several islets and rocks lying off this and the northern side of the island.

During the South-west monsoon, good anchorage may be obtained near the head of a bay on the northern side of St. Paul's island, in a 45 depth of 4 fathoms (7^m3).

Tidal streams.—In Investigator channel the tidal stream sets east-north-eastward on the rising and west-south-westward on the falling tide, with rates of half a knot at springs.

Charts 3051, 3052.

50

St. Matthew's island.—**Anchorage.**—St. Matthew's island, the northern side of which forms the southern shore of Hastings harbour (*see* below), is hilly and densely wooded. Highest peak, 2,835 feet (864^m1) high, situated at about the middle of the island, and South

Charts 3051, 3052.

peak, 1,920 feet (585^m3) high, about 6½ miles south-south-westward of Highest peak and about 2¼ miles northward of the southern extremity of the island, are both well defined. Fish harbour, close to the north-eastern extremity of the island, affords anchorage to small vessels with local knowledge of a draught not exceeding 9 feet (2^m7). White rock, 30 feet (9^m1) high, with a 2-fathom (3^m7) patch close south-eastward of it, lies about three-quarters of a mile south-eastward of Fish harbour entrance. The south-eastern coast of St. Matthew's island is much indented and is densely wooded to the water's edge. Tongue island, 370 feet (112^m8) high, steep-to and densely wooded, with a bare grassy mound at its southern end, lies close off the south-eastern coast about 2½ miles south-eastward of Highest peak. South bay, a bight in the southern end of the island, affords sheltered anchorage at all times of the year, in a depth of 10 fathoms (18^m3), sand and shells, but there is a 6-fathom (11^m0) patch in the entrance.

Hastings harbour. — Entrances. — Islets and dangers. —

Anchorage.—Hastings harbour is formed by St. Luke's island on the west, Hastings island on the east, and St. Matthew's island on the south. There are three entrances to the harbour.

The northern entrance lies between Bengal point, the north-eastern extremity of St. Luke's island, and Minto point, the north-western point of Hastings island, about 2¼ miles south-eastward. Haycock island, an islet 330 feet (100^m6) high and covered with dense jungle, lies about 8 cables south-eastward of Bengal point and the entrance channel lies between it and Minto point, about 1½ miles south-eastward. Thomson shoal, a 7-foot (2^m1) patch, lies nearly in mid-channel about 6½ cables from Minto point; the patch can be passed on either side with perfect safety and the channel is otherwise clear of dangers.

The eastern entrance lies between Cornwallis point, the southern extremity of Hastings island, and Dufferin point, the northern extremity of St. Matthew's island, about 1¼ miles south-south-westward. Chaves shoal, with a depth of 17 feet (5^m2) over it, lies on the southern side of the entrance channel, about 7½ cables south-south-westward of Cornwallis point. James patch, with a depth of only 2 feet (0^m8) over it, lies on the northern side of the entrance, about 9 cables east-south-eastward of Cornwallis point (*Lat. 10° 05' N., Long. 98° 18' E.*); except for these two dangers, this entrance is clear.

The western entrance, between St. Luke's and St. Matthew's islands, is shoal and intricate and should not be attempted except by small craft and boats. In this entrance, the current at springs runs at a rate of 3 knots. The water here is frequently muddy, probably caused by the proximity of Pakchan river and the shoals cannot be seen, even from aloft.

Ryland patch, a coral rock of small extent, lies in the south-western corner of the harbour and dries one foot (0^m3); it is situated about 1½ miles east-south-eastward of Evelyn peak, 970 feet (295^m7) high and a prominent landmark in the southern part of St. Luke's island. There are depths of 3½ fathoms (6^m4) close to Ryland patch.

St. Mark's islet, 575 feet (175^m3) high, lies in the south-western part of the harbour, about 1¼ miles southward of Ryland patch; there is a boat channel with a depth of 10 feet (3^m0) at high water in the channel between St. Mark's islet and the north-western coast of St. Matthew's island and there is a small islet and several rocks in this channel.

Charts 830, 70.

Charts 3051, 3052.

St. John's islet, 400 feet (121^m9) high, lies on the north-eastern side of Hindustan bay, close off the eastern side of St. Luke's island, about 3 miles southward of Bengal point.

Frequent patches of discoloured water appear in the harbour but examination has proved that these do not indicate dangers. The reefs which fringe the shores of the harbour are quite distinct and rise precipitously from depths of from 3 to 5 fathoms (5^m5 to 9^m1).

The harbour, which is very picturesque, affords excellent and safe anchorage. A completely sheltered area affords ample accommodation for the largest vessels in depths varying from 6 to 12 fathoms (11^m0 to 21^m9). A lee is always obtainable and no sea or current of any consequence is experienced. Anchorage may be obtained anywhere, the holding ground is very good, being generally of mud.

Tracks of large animals and sambur have been seen on the shores of the harbour, notably on the north-western coast of St. Matthew's island. Good deep sea fishing can be obtained off Little Russell island (*Lat.* 10° 13' N., *Long.* 98° 15' E.) and off the western coast of St. Luke's island.

Tidal streams.—Between South Hump and Hastings islands the tidal stream sets eastward during the rising and westward during the falling tide, with rates of about 1½ knots at springs.

In Hastings harbour the tidal streams are negligible, but set through the eastern and western entrances at rates of from 3 to 4 knots.

Chart 3052.

Aladdin islands.—Dangers.—Aladdin islands are a scattered group of islands extending between about 15 miles westward and 18 miles south-south-westward of the southern end of St. Matthew's island, the westernmost of the group, is 70 feet (21^m3) high; a detached rock, 35 feet (10^m7) high, lies about one cable north-eastward of it with some smaller rocks between. North Rocky island, 120 feet (36^m6) high, and covered with scrub, lies about 5½ miles east-north-eastward of Western Rocky island and is surrounded by off-lying rocks.

Davis island, the largest and highest of the Aladdin group, is situated about 4 miles west-south-westward of the southern end of St. Matthew's island and is densely wooded; it has two main peaks, the western of which, 1,495 feet (455^m7) high, is slightly the higher. A rock, 18 feet (5^m5) high, surrounded by a reef extending about one cable from it, lies close off the eastern extremity of Davis island. Chimney island, 140 feet (42^m7) high, lies about 1½ miles north-north-westward of the north-eastern point of Davis island with several rocks between; the northernmost of these rocks dries 3 feet (0^m9).

Drake island, 470 feet (143^m3) high, lies about three-quarters of a mile southward of Davis island with a deep channel between them. Glasshouse island, 450 feet (137^m2) high, bold and rocky, lies about 1½ miles west-south-westward of Drake island, with a rock, 170 feet (51^m8) high, close off its western end. Slave island (*Lat.* 9° 43' N., *Long.* 98° 00' E.), 210 feet (64^m0) high, lies about 2 miles southward of Glasshouse island; a chain of rocks, of which Pat rock, the southernmost, has an elevation of 125 feet (38^m1), and Sheila rock, at the northern end of the chain, an elevation of 200 feet (61^m0), extends about 1½ miles north-north-westward from Slave island. A reef, 2 feet (0^m6) high, lies about one mile southward of Slave island.

Charts 830, 70.

Chart 3052.

Lamp island, 320 feet (97^m5) high, lies about 2½ miles southward of Drake island with Honor rock, over which there is a depth of 2 feet (0^m6), about midway between them. About half a mile southward of Lamp island are North and South Brother, two large rocks, 150 and 195 feet (45^m7 and 59^m4) high, respectively, and about 2 cables southward of South Brother is Kai kan (Kai kah) rock, which dries 3 feet (0^m9).

Haycock, an isolated rock, 230 feet (70^m1) high and steep-to, lies about 5½ miles west-south-westward of Slave island. About 4 miles south-eastward of Haycock is Christie island, the southernmost of the Aladdin group; it is well wooded and has several peaks, the highest of which, situated at its north-western end, has an elevation of 1,065 feet (324^m6). Sanders island, 350 feet (106^m7) high, and Murray island, 235 feet (71^m6) high, are both rocky and lie about three-quarters of a mile eastward, and half a mile south-south-westward, respectively, of the southern point of Christie island. A rock, 18 feet (5^m5) high, lies close off the northern point of Murray island, and the passage between Christie and Murray islands is foul.

Cash island, 370 feet (112^m8) high, lies about three-quarters of a mile southward of the south-western extremity of St. Matthew's island; Mawken passage, the channel between them, has considerable depths and provides a short cut for power vessels proceeding westward from Victoria point; there are strong tide-rips in the passage at springs and it is inadvisable to attempt to use the passage after dark. Two rocks, the southern of which is 20 feet (6^m1) high, lie in the passage within a distance of 3 cables from the south-western extremity of St. Matthew's island. Two rocky islets, 120 and 140 feet (36^m8 and 42^m7) high, respectively, lie about a quarter of a mile eastward, and half a mile southward, respectively, of Cash island.

Dunkin island, 780 feet (237^m7) high near its northern end, lies about three-quarters of a mile southward of Cash island. The Sisters, two rocks, 80 and 75 feet (24^m4 and 22^m9) high, and steep-to, lie about half a mile southward of Dunkin island.

Bruer island, 960 feet (292^m6) high and densely wooded near its south-eastern end, lies about 3 miles southward of Dunkin island. A rock, with a depth of less than 6 feet (1^m8) over it, the position of which is approximate, lies about one mile south-south-westward of the southern extremity of Bruer island. Auriol island, 600 feet (182^m9) high at its western end and densely wooded, lies about 2½ miles southward of Bruer island; a rock about 3 feet (0^m9) high lies about one cable off the north-western coast of the island. Swallow island, 290 feet (88^m4) high, lies about half a mile northward of Auriol island with shoal depths between them.

Graham island, 540 feet (164^m6) high, lies about 2 miles westward of Auriol island with two prominent rocks, 60 and 125 feet (18^m3 and 38^m1) high, close to its northern end. Ninepins rock, 80 feet (24^m4) high, lies about half a mile south-south-eastward of the southern end of Graham island (*Lat.* 9° 38' N., *Long.* 98° 03' E.).

A 3-fathom (5^m5) shoal, the position of which is doubtful, lies about 5½ miles south-eastward of Auriol island.

Birds Nest rocks.—Birds Nest rocks consist of two groups of rocks lying within about 5 miles south-south-eastward and 4½ miles eastward of the south-eastern extremity of St. Matthew's island.

Chart 3052.

The principal rocks in the southern group are Cocks Comb (*Lat.* $9^{\circ} 45' N.$, *Long.* $98^{\circ} 09' E.$), 660 feet (201^m2) high and the southernmost and largest, and Spur rock, 490 feet (149^m3) high, about half a mile north-eastward of it; in the northern group, which lies about $2\frac{1}{2}$ miles 5 north-north-eastward of Spur rock, the chief rocks are, Horse Shoe, 390 feet (118^m9) high, Cupola, 695 feet (211^m8) high, Tower rock, 470 feet (143^m3) high, Square rock, 270 feet (82^m3) high, and Sloop rock, the northernmost of the group, 290 feet (88^m4) high.

Ko Sindarar.—Dangers.—Ko Sindarar, consisting of Ko Sindarar 10 Nua and Ko Sindarar Tai, lie about 10 miles south-westward of Christie island: they are separated by a narrow winding channel, which nearly dries, and, from a distance, appear as a single island. Both islands are high and densely wooded, and the highest point, which is near the northern extremity of the southern island, is a prominent 15 summit, 1,210 feet (368^m8) high. Torilla and Pachumba (*Lat.* $9^{\circ} 25' N.$, *Long.* $97^{\circ} 50' E.$), two islets, 385 and 535 feet (117^m3 and 163^m1) high, respectively, and Stork islet, 330 feet (100^m6) high, are steep-to, lying, respectively, off the southern, western and northern sides of Ko Sindarar. A rocky islet, 42 feet (12^m8) high, with rocks, 2 feet (0^m6) 20 high, close westward, lies about one mile north-eastward of the south-eastern extremity of Ko Sindarar Tai, and in the southern approach to the bay on the eastern side of Ko Sindarar: this group of rocks is steep-to and separated from the southern island by a channel, more than half a mile wide, with a depth of about 20 fathoms (36^m6). 25 Another rocky islet, 46 feet (14^m0) high and steep-to, lies about three-quarters of a mile north-westward of the northern extremity of Ko Sindarar Nua, and about $1\frac{1}{2}$ miles west-south-westward of Stork islet. A shoal, with a depth of 8 fathoms (14^m6) over it, was reported, in 1945, about one mile northward of Pachumba, but generally speaking, 30 Ko Sindarar and their off-lying islets are remarkably steep-to and except for this shoal there are no dangers off-lying at an appreciable distance.

Marshall rock, a pinnacle with a least depth of 24 feet (7^m3), rising from depths of over 20 fathoms (36^m6), lies about $2\frac{3}{4}$ miles westward 35 of the southern point of Ko Sindarar Tai.

Richelieu rock lies about 9 miles eastward of Torilla island and dries 4 feet (1^m2): it is a small coral pinnacle, rising from depths of about 20 fathoms (36^m6); the sea does not always break over this rock at high water, even in a considerable swell. 40

Anchorage.—The eastern sides of Ko Sindarar form a bay affording anchorage with excellent shelter from westerly winds. Anchorage with good holding ground, in a depth of 25 fathoms (45^m7), sandy bottom, may be obtained with the 42-foot (12^m8) islet bearing 167° , 45 distant about one mile.

The outlying islands lying southward of Ko Sindarar are described on page 483.

Chart 830.

PAKCHAN RIVER AND APPROACHES.—Pakchan river rises in about *lat.* $10^{\circ} 50' N.$, *long.* $99^{\circ} 00' E.$, and is about 80 miles in 50 length. It forms the boundary between the territories of Burma and Thailand. Both its banks are densely wooded and numerous streams flow into it.

Chart 70.

Chart 3051.

The country northward of Victoria point is very hilly ; parts of it have been cleared and the remainder is covered with trees and jungle. The summits are flat-topped and are not easily identified. The coast
 5 between Pulau Mah Puteh (page 463) and Victoria point is mostly low, and, in parts, bordered with mangroves. There are two bluff headlands, one at Tanjong Padah, about $7\frac{1}{2}$ miles northward of Victoria point, and the other about $2\frac{1}{4}$ miles farther southward. Extensive sand and mud flats and numerous small reefs fringe this
 10 coast.

Small motor craft are frequently employed dredging and diving for mother of pearl shell off the entrance to the river.

Victoria point is the southern extremity of the Maliwun hills and the northern entrance point of Pakchan river ; it is high, bold and
 15 steep-to ; an iron flagstaff, 76 feet (23^m2) in height and with an elevation of 188 feet (57^m3), stands on the point. Two radio masts with elevations of 383 feet (116^m7) are situated near the coast about 8 cables northward of the flagstaff.

The approaches to the river mouth are encumbered by numerous
 20 islands, reefs and shoals, through which are three main channels, which are available, respectively, to vessels from northward, westward and southward.

Islands and dangers in the northern approach.—Beacons.—

There are several islands on the extensive bank which fronts the coast
 25 between Victoria point (*Lat. $9^{\circ} 58' N.$, Long. $98^{\circ} 33' E.$*) and Pulau Mah Puteh (page 463), about 14 miles north-north-westward. Pulau Remiah, the northernmost of these islands, is 60 feet (18^m3) high, and lies about three-quarters of a mile southward of Tanjong Padah.

A group of islands, islets and reefs lies between 5 miles north-
 30 westward, and a similar distance westward of Victoria point ; Sims reef, which dries 9 feet (2^m7), lies about $5\frac{1}{4}$ miles, north-westward of Victoria point and is marked by a beacon, 23 feet (7^m0) in height, surmounted by a ball. Thane island, *see* view facing page 480, lies about 4 cables eastward of Sims reef ; a small reef which dries about
 35 11 feet (3^m4) lies close southward of it. Pulau Tonton, 405 feet (123^m4) high, situated about 4 miles north-westward of Victoria point, has been partially cleared and there are villages on its eastern and western coasts ; it is connected with the mainland eastward and south-eastward by a drying bank of sand and mud which extends nearly to Victoria
 40 point.

Charts 3051, 3052.

Pulau Besin, 645 feet (196^m6) high and the largest island of the group, lies with Monkey point, its north-eastern extremity, about one mile south-south-westward of the southern point of Pulau Tonton ;
 45 several off-lying reefs which dry about 6 feet (1^m8), one of which is marked by a beacon surmounted by a globe, lie close off its eastern side. Akha Barit, 215 feet (65^m5) high and steep-to, lies about half a mile northward of Monkey point.

Pulau Jungis, 600 feet (182^m9) high, lies about 4 cables northward
 50 of Pulau Besin ; a shoal bank, on which the depths are less than 6 feet (1^m8), extends about $4\frac{1}{2}$ miles northward from Pulau Jungis. Pulau Perlin, 480 feet (146^m3) high, lies about 4 cables southward of the south-eastern point of Pulau Besin ; two small reefs, which dry about 6 feet (1^m8), lie within 8 cables southward of Pulau Perlin. A white beacon

Charts 3051, 3052.

surmounted by a white globe, stands on the northern of these reefs.

Pulau Besin, Pulau Jungis and Pulau Perlin all lie on a shoal bank, that part of which between the two former islands dries.

Chart 3052.

5

Islands and dangers in the southern and western approaches

—**Light.**—K_o Phayam (Goh Piam), situated about 15 miles south-westward of Victoria point, is the outermost island in the southern approaches to Pakchan river; it is densely wooded and has a prominent peak, 790 feet (240^m8) high. On the western side of the island 10 are two bays and, during the North-east monsoon, vessels with local knowledge may obtain good anchorage in the southern bay, in a depth of 5½ fathoms (10^m1), sand and mud, off a sandy beach about 1½ miles long. A rocky islet, 50 feet (15^m2) high, lies about 3 cables off the south-western point of K_o Phayam, and about half a mile south- 15 westward of the islet is a rock which dries 5 feet (1^m5), with depths of from 7 to 8 fathoms (12^m8 to 14^m6) close-to. There are extensive sandbanks between K_o Phayam and the mainland, but there is a channel on the island side.

K_o Chang, situated about 2 miles north-north-eastward of K_o 20 Phayam, attains an elevation of 1,280 feet (390^m2) in the middle of the island (*Lat. 9° 50' N., Long. 98° 27' E.*); it also is densely wooded and is the highest of the islands along this part of the coast. Large sandbanks extend from its eastern side as well as from the mainland opposite; between them is a narrow and shallow channel, difficult 25 to distinguish at high water but visible at low water, between drying banks on either side.

Some wooded islets lie off the southern end of K_o Chang, the nearest of which is about 3 cables offshore and about 300 feet (91^m4) high. A sandbank, on which the depths are less than 3 fathoms (5^m5), extends 30 about 1½ miles towards the northern end of K_o Phayam from the south-western side of K_o Chang; there are depths of from 26 feet to 15 fathoms (7^m9 to 27^m4) between the extremity of this bank and K_o Phayam, but a 2-fathom (3^m7) sandy patch lies about 4 cables eastward of the northern point of the latter island. 35

Charts 3051, 3052.

Harry head, the northern point of K_o Chang, is a high, tree-covered bluff. Tree island, 45 feet (13^m7) high and wooded, lies about 1½ miles south-westward of Harry head and about 3 cables offshore; a rock, 2 feet (0^m6) high, lies about one mile southward of Tree island. On 40 the northern side of K_o Chang is a shallow bay, with K_o Lop Rap (Bushy islet) forming its eastern side; about 4½ cables eastward of this islet is Stainer rock, which is low and bushy.

Banlin or Banrim river enters the sea eastward of the southern part of K_o Chang and about 2 miles northward of its northern entrance 45 point is Khao Bang Chak (Seaward peak), 1,315 feet (400^m8) high. Between the mouth of this river and the entrance to Ra-nohng creek, about 9½ miles north-north-eastward, the coast consists almost entirely of mangroves and is fronted by extensive sand and mudbanks.

K_o Khan (Goh Kan), a rocky islet lying about half a mile north- 50 westward of Harry head, is steep-to on its southern and eastern sides. Several shoal patches, with a least depth of 3 feet (0^m9), extend as much as 2½ miles west-south-westward of K_o Khan.

A light is exhibited, at an elevation of 180 feet (54^m9), from a white,

Charts 830, 70.

Charts 3051, 3052.

circular, masonry tower, 39 feet (11^m9) in height, situated on the summit of Kō Khan. The tower is not easily distinguished by day on account of the surrounding trees which obscure all but the top.

- 5 A group of islands and islets, surrounded by banks and shoals, lies between Kō Khan and Victoria point. The principal islands in the group are Pulau Pingngwe, 605 feet (184^m4) high, about 1½ miles north-eastward of Kō Khan; Dyke island and Pulau Saung Kharang, about 1½ miles eastward of Pulau Pingngwe; Round island, about
10 three-quarters of a mile eastward of Pulau Saung Kharang; Pulau Ganga, about one mile northward of Pulau Pingngwe with Pulau Gattai about 2 miles eastward of it; and Pulau Ru, 610 feet (185^m9) high, situated with its southern point about a quarter of a mile eastward of Pulau Gattai and its north-eastern point about one mile southward
15 of Victoria point.

- A bank which dries about 3 feet (0^m9) extends as much as one mile east-south-eastward from the south-eastern side of Pulau Pingngwe and a shoal, with a least depth of 5 feet (1^m5) over it, lies about 6 cables southward of the southern point of that island. Reefs and foul ground
20 extend about three-quarters of a mile westward from Pulau Saung Kharang. A narrow spit which dries extends about 1½ miles westward from Pulau Gattai (*Lat.* 9° 55' N., *Long.* 98° 31' E.) and nearly joins that island with Pulau Ganga, and a shoal, with a least depth of 4 feet (1^m2), extends about 1½ miles westward of the latter island.

- 25 Dyke island, Pulau Saung Kharang, Pulau Gattai and Pulau Ru are all separated from one another by narrow channels.

- Round island, 290 feet (88^m4) high and steep-to, lies about three-quarters of a mile south-eastward of the southern end of Pulau Ru, the intervening channel being deep. A bank, on which the depths
30 are less than 3 fathoms (5^m5), the inner part of which dries, fronts the western side of Pulau Ru and extends as much as 4½ miles westward from it; Pulau Ganga lies on this bank.

- Approach channels.—Anchorages.**—There are three navigable approach channels to Pakchan river. The northern approach channel
35 lies between Pulau Remiah and the shoal ground extending northward from Pulau Jungis and has a least depth of 11 feet (3^m4) in the fairway westward of Pulau Remiah. The track there leads between Sims reef and Thane islet and, farther southward, between Akha Barit and Monkey point.

- 40 The western approach channel lies between Pulau Perlin and the reefs lying within about 8 cables southward of that island.

- The southern approach channel, named Bell passage, lies between Kō Khan and Harry head and thence runs eastward in a deep channel between the northern coast of Kō Chang and the shoal southward
45 of Pulau Pingngwe. The track then leads south-eastward of the drying bank extending south-eastward of Pulau Pingngwe and thence leads south-eastward of Round island.

- Sheltered anchorage can be obtained in the northern approach channel between Pulau Jungis and Pulau Tonton; in the southern
50 approach channel, sheltered anchorage may be obtained southward of Pulau Pingngwe, and, for shallow-draught vessels, eastward of Pulau Ru.

Vessels with local knowledge may obtain good anchorage in depths of from 5 to 6 fathoms (9^m1 to 11^m0), with shelter from the South-west monsoon, off the north-eastern side of Kō Phayam.

Charts 3051, 3052.

Entrance to Pakchan river. — Dangers. — Light. — Anchor-ages.—The entrance to Pakchan river lies between Victoria point and the entrance to Ra-nohng creek, about $2\frac{1}{2}$ miles east-south-eastward. The small Victoria point harbour, in which is the village of Kawsong, lies on the eastern side of the point, between it and Browning island, about 3 cables eastward. Vessels usually anchor about half a mile southward of Victoria point, in depths of from 5 to 10 fathoms (9^m1 to 18^m3).

A shoal, with a least depth of 11 feet (3^m4) over it, lies in the entrance to Pakchan river, and extends about $1\frac{1}{2}$ miles south-westward from a position about midway between Victoria point and the entrance to Ra-nohng creek.

Chart 3052, plan of Ra-nohng anchorage.

K ϕ Phi (Goh Phi) is an islet lying about a quarter of a mile northward of the entrance to Ra-nohng creek and about $2\frac{1}{2}$ miles east-south-eastward of Victoria point; a sandbank with depths of from 3 to 11 feet (0^m9 to 3^m4) extends about $2\frac{1}{4}$ cables south-south-westward from it.

A light is exhibited, at an elevation of 60 feet (18^m3), from an iron pile structure, 33 feet (10^m1) in height, situated on K ϕ Phi (*Lat.* $9^\circ 58' N.$, *Long.* $98^\circ 35' E.$).

Vessels anchoring off Ra-nohng creek, usually anchor in depths of 15 feet (4^m6), about $3\frac{1}{2}$ cables south-south-westward of K ϕ Phi, with the light-structure bearing 020° .

Charts 3051, 3052.

Tidal streams.—Near the coast southward of Pulau Mah Puteh, the tidal stream sets southward with the rising tide and northward during the falling tide.

In the northern approach channel the tidal streams run generally parallel with the track, at a rate of 2 knots at springs.

Southward of Pulau Perlin, and off the islands southward, the stream sets eastward with the rising tide and westward with the falling tide.

In the southern approach channel the tidal streams usually run parallel with the track, setting towards the entrance with the rising tide and away from it with the falling tide. There are strong tide-rips in the channel between K ϕ Khan and Harry head, both streams setting strongly towards K ϕ Khan.

Between K ϕ Chang and the mainland, the tidal stream sets northward with the rising tide and southward during the falling tide.

Between K ϕ Chang and K ϕ Sindarar the tidal streams set north-eastward with the rising tide and south-westward with the falling tide, with rates of about three-quarters of a knot at springs.

The ebb stream from Pakchan river divides at the north-eastern point of Pulau Ru, one part setting westward and the other southward. The flood stream sets eastward past the northern side of Pulau Ru, and then turns north-eastward towards the entrance to the river. There are tide-rips in the channel northward of Pulau Ru.

Directions.—Caution.—As the channels are not buoyed, great caution is necessary.

Northern approach channel.—From a position about 4 miles westward of Pulau Mah Puteh, vessels should steer for Thane islet, bearing about 149° . If visible, a prominent double peak on the mainland, known

Charts 830, 70.

Charts 3051, 3052.

locally as "The Donkey's Ears," in line with the eastern tangent of Thane islet, makes an excellent leading mark for this course. It is reported that, due to low cloud, The Donkey's Ears are seldom visible
5 before midday. See view facing page 480.

When Sims reef beacon bears 185° , course should be altered to 172° , to pass between Sims reef and Thane islet, and when the northern point of Akha Barit bears 090° , course should be altered to 148° to avoid the 13-foot (4^m0) patch situated south-westward of Akha
10 Barit and the reefs off the eastern coast of Pulau Besin. Vessels can pass very close to the south-western coast of Akha Barit, which is steep-to.

When the south-eastern and south-western points of Pulau Besin are in line, course should be altered to 128° .

15 When K ϕ Phi lighthouse bears 095° , it should be steered for, on that bearing, until Victoria point bears 045° , when course may be altered for the selected anchorage. Vessels bound for the anchorage off K ϕ Phi should, after passing Victoria point, approach K ϕ Phi from a more northerly direction, in order to avoid the shoal in the
20 middle of the channel, mentioned on page 475.

Western approach channel.—From a position about 9 miles westward of Pulau Ganga, vessels should steer for that island bearing 090° until the south-eastern point of Pulau Besin bears 061° , when they should steer for it on that bearing. The least depths on this
25 track are about 19 feet (5^m8), which are found after proceeding about 2 miles along the latter track.

When the south-eastern point of Pulau Perlin bears 090° , steer for K ϕ Phi lighthouse bearing 095° , this leads between Pulau Perlin and the beacon marking the reef southward of that island; the south-
30 eastern point of Pulau Perlin may be passed at a distance of one cable. Vessels should continue on this course until the directions given above for the northern approach can be followed.

Southern approach channel.—Vessels should steer for Pulau Pingngwe summit bearing about 048° , which course leads through the channel
35 between K ϕ Kan and Harry head, Tree island being 4 cables distant when abeam. The least depth on this track is 24 feet (7^m3), and is found about 8 cables south-westward of K ϕ Khan (*Lat. $9^\circ 53' N.$, Long. $98^\circ 27' E.$*). Vessels approaching this track from northward should keep westward of the shoals in the approach until the summit
40 of K ϕ Chang bears 120° , when course may be altered to bring Pulau Pingngwe summit to bear about 048° , then course should be altered to steer for the last-mentioned island on that bearing.

When the north tangent of K ϕ Khan bears 270° and is in line with South peak on St. Matthew's island, course should be shaped to make
45 good 090° , keeping this mark on astern. When the summit of Pulau Pingngwe bears 335° , alter course gradually to 045° , and steer for the lighthouse on K ϕ Phi right ahead on that bearing. Vessels bound for the anchorage off K ϕ Phi should keep on this course until conveniently near the anchorage. The least depth on this track is
50 30 feet (9^m1).

Vessels bound for Victoria point should keep on this course until the summit of Round island bears 270° , when course should be altered northward, and Browning island steered for, bearing 013° . The least depth on this track, which is about one mile north-eastward

Charts 830, 70.

Charts 3051, 3052.

of Round island, is 25 feet (7^m6). When past the north-eastern point of Pulau Ru, course may be shaped direct for the anchorage.

Chart 3052, plan of Victoria point harbour.

Victoria point harbour.—Anchorage.—Settlement.—Victoria point harbour is entered between the eastern side of Victoria point and the southern end of Browning island, about 3¼ cables east-north-eastward. 5

A bank, on which the depths are less than 3 fathoms (5^m5), the inner part of which dries, extends about 1½ cables west-south-westward from the southern end of Browning island and there are depths of from 13 feet to 3 fathoms (4^m0 to 5^m5) between the outer edge of the bank and Victoria point. A pier, at the root of which is the Custom house, extends about 450 feet (137^m2) from the western shore of the harbour. 15

There is anchorage in depths of from 7 to 8 fathoms (12^m8 to 14^m6) over an area about 1½ cables long and three-quarters of a cable wide, off the Custom house pier.

The settlement of Kawsong at Victoria point (*Lat.* 9° 58' N., *Long.* 98° 33' E.) is the southernmost in Burma and is a small frontier station facing the Thailand province of Ra-nohng; it consists of a small village near the point and has a mixed population. On the summit of the hill at the point is the police station, and on the ridge northward are a hospital and Government buildings. There is an aerodrome situated about 7 miles northward of Victoria point. 20 25

In 1936-37, 74 vessels of 61,440 tons entered Victoria point harbour. There is regular sea communication with Penang, Mergui and Rangoon.

Winds.—See percentage frequency of wind direction on page 90. *Chart 3052, plan of Ra-nohng anchorage.* 30

Ra-nohng town.—The town of Ra-nohng is situated about 2 miles above the entrance to the creek of that name, which enters Pakchan river opposite Victoria point. Ra-nohng creek is narrow and can only be navigated near high water, even by small launches. The town of Ra-nohng is the headquarters of the Governor of the province. 35

Chart 3051.

River above Victoria point.—The river has a general north-north-easterly direction. During the South-west monsoon, or rainy season, small power vessels reach the Thailand town of Kraburi, situated about 28 miles above Victoria point; the river here is about 250 feet (76^m2) wide; above Kraburi it becomes tortuous. 40

Glohng Maliwun flows into Pakchan river, on the Burmese side, about 14 miles above Victoria point. It is broad and available for vessels of from 12- to 13-foot (3^m7 to 4^m0) draught for about 3 miles above the entrance. Higher up the Maliwun becomes narrow and tortuous, but it can be navigated by power launches as far as Maliwun, a small settlement situated about 9 miles up the Glohng Maliwun. 45

Directions.—From abreast Victoria point (*Lat.* 9° 58' N., *Long.* 98° 33' E.), vessels with local knowledge should keep in mid-channel and pass eastward of the above-water rocks, off Kō Muang (Goh Muīng) or Pulau Pao, about 5 miles above Victoria point; then close the western bank of the river, keeping westward of all the islands up to the entrance to Glohng Maliwun, and thence if proceeding into the latter river keep in mid-channel to the anchorage about 3 miles within the entrance. 55

Charts 830, 70.

Chart 3051.

- To proceed up Pakchan river above the Maliwun, steer between K_o Mut and K_o Khwang (Goh Kamut and Goh Kwan) about 4 miles above K_o Muang, where there are depths of about 16½ feet (5^m0) ;
 5 then close the western bank of the river, keeping about 2 cables from it, and avoiding a rocky patch which dries about 4 feet (1^m2), situated about 1½ cables off the northern entrance point of Glohng Kamou Yei, about 4 miles farther up. Continue about the same distance from the west bank past the entrance of Glohng Kamou Duen.
 10 A rocky patch, which dries about 9 feet (2^m7), lies about half a cable from the western bank, three-quarters of a mile northward of the entrance to Glohng Kamou Duen. Vessels of shallow draught can proceed about 4 miles above Glohng Kamou Duen, keeping nearer the west bank ; higher up, the river is navigable for vessels
 15 of about 10-foot (3^m0) draught at high water only.

*Chart 3052.***KHAO BANG CHAK TO CASUARINA POINT.—Coast.—**

- Between Khao Bang Chak (Seaward peak) (*Lat.* 9° 50' N., *Long.* 98° 33' E.), and Casuarina point, about 38 miles south-south-west-
 20 ward, the coast is generally low, densely wooded and intersected by numerous creeks and rivers. Several wooded islands, mostly fringed by reefs, lie off this coast.

- A range of mountains about 10 miles inland extends along this stretch of coast. Khao Ph_o Ta Chong Dong (Round or Funnel
 25 mountain), 3,182 feet (969^m9) high, and situated about 14 miles eastward of the southern extremity of K_o Phayam (page 473), has a very distinct conical summit with a peak of almost perpendicular appearance. Khao Phrami (Pia Sima), about 5½ miles east-north-eastward of Casuarina point, is the highest mountain in this vicinity ;
 30 it culminates in three peaks, each over 3,500 feet (1,066^m8) high.

- Khl_ong Bang Ben (Bane) is an extensive shallow inlet, entered about 7 miles south-eastward of the southern end of K_o Phayam. The channel lies on the southern side of the entrance, but has depths only of from one to 2 fathoms (1^m8 to 3^m7) in it. Depths of one fathom
 35 (1^m8) and less extend over one mile offshore southward and westward of the northern entrance point.

- Shong Pianam.—Anchorage.—Directions.**—Shong Pianam, or the "Entrance to the three big rivers," is an extensive inlet, entered between K_o Pianam, a wooded island, 750 feet (228^m6) high, situated
 40 about 9 miles south-south-eastward of the southern extremity of K_o Phayam, and Hl_æm (Lem) Tansheen, a point which rises to an elevation of 435 feet (132^m6) about 4 cables south-eastward of its extremity, situated about three-quarters of a mile south-westward of K_o Pianam. The entrance is about a quarter of a mile wide with
 45 irregular depths of from 10 to 16 fathoms (18^m3 to 29^m3). There are a few small and scattered villages around the shores of the inlet.

- Small vessels with local knowledge may obtain good anchorage, in depths of from 5 to 9 fathoms (9^m1 to 16^m5), mud, about half a mile inside the entrance.

- 50 About 3½ miles westward of the entrance is the outer edge of a bar about one mile in width, with depths over it of from one to 2 fathoms (1^m8 to 3^m7), sand and mud. The tidal streams attain a rate of from 2 to 3 knots at springs in the narrow part of the entrance ; in the

Chart 3052.

offing and on the bar, they attain a rate of about one knot at springs, the north-going stream of the rising tide being stronger than the south-going stream of the falling tide.

The following directions lead across the bar and into the inlet in a least charted depth of 13 feet (4^m0). From a position about half a mile northward of Hin Sawai, *see* below, vessels should steer for a 300-foot (91^m4) hill at the northern end of Kọ Pianam, bearing 089°; when the summit of Hlæm Tansheen (*Lat.* 9° 33' N., *Long.* 98° 28' E.) bears 132°, course should be altered south-eastward and the point kept on that bearing; when a conical hill at the head of the inlet, 695 feet (211^m8) high, bears 095°, it should be steered for on that bearing which leads through the entrance and to the anchorage.

Off-lying islands.—Kọ Khang Khao (Goh Kang Kao), 515 feet (157^m0) high and wooded, with its eastern side fringed with rocks which extend about one cable offshore, lies about 8 miles southward of Kọ Phayam and about 4 miles westward of Hlæm Tansheen. Hin Sawai, 21 feet (6^m4) high, with a white summit, lies about 4 cables northward of Kọ Khang Khao.

The Kọ Kam (Goh Kam) group of islands lies between 3 and 6½ miles south-south-westward of Kọ Khang Khao and about 3 miles offshore; they are bold and well wooded and consist of Kọ Kam Tok (Look Goh Kam Tok), 345 feet (105^m2), Kọ Kam Hyai (Goh Kam Yai), 1,030 feet (313^m9), Kọ Kam Nui (Goh Kam Nui), 945 feet (288^m0) high, and several smaller islands.

Kọ Kam Hyai is the largest and outermost island of the group and depths of 6 fathoms (11^m0) and less extend about 1½ miles off its western side. The depths between the islands of this group are very irregular and no attempt to pass between them should be made. An extensive sandbank, with depths of less than 6 feet (1^m8) over it, lies about half a mile eastward of the southern point of Kọ Kam Hyai.

Double islet, which consists of two peaks, the northern one 272 feet (82^m9) high and the southern one 146 feet (44^m5) high, joined by a low and narrow strip of sand, lies about half a mile south-westward of the southern point of Kọ Kam Hyai; a rock with a depth of less than 6 feet (1^m8) over it lies about 2 cables north-eastward of the northern peak of Double islet. South rock, 19 feet (5^m8) high, lies about half a mile south-westward of Double islet.

Kọ Lan (Goh Larn), 730 feet (222^m5) high and wooded, lies about 2 miles south-south-eastward of the southern point of Kọ Kam Hyai and about 3¼ miles offshore; a sandy spit, with depths of one fathom (1^m8) and less over it, extends about 1¼ miles east-north-eastward from Kọ Lan.

Between the entrance to Khlọng Bang Ben and Hlæm Kluai (Lem Klu-e), a projecting headland, 600 feet (182^m9) high, about 15 miles south-south-westward, the coast is fronted by a bank on which the depths are less than 3 fathoms (5^m5); a tongue of this shorebank extends as far as the eastern side of Kọ Kam Hyai, and Double islet and Kọ Lan lie on the southern edge of the tongue.

Kọ Nui (Goh Nui), a small islet, 196 feet (59^m7) high, lies about half a mile west-south-westward of Hlæm Kluai, and shoal patches extend about 4 miles west-south-westward of that point, and about ¾ miles offshore.

Chart 3052.

K_o Khai Hyai (Goh Khai Jai), situated about 6 miles south-westward of Hlæm Kluai, is high and wooded. Umbrella island, situated about three-quarters of a mile north-westward of K_o Khai Hyai, is 5 rocky and shows up prominently when not in line with the latter island. Both these islands are surrounded by sandbanks and rocks and, at low water, breakers occur in several places westward and southward of them.

- TAKUA PA INLET AND APPROACHES.—Caution.**—Takua Pa (Taukopah) inlet is the estuary of a large river in the province of Muang Takuapah; it has four entrances, the principal one being Pak Kura, which lies between the mainland coast and K_o Ra (Goh Rah), the northern extremity of which lies about 4 miles south-south-westward of K_o Khai Hyai (*Lat. 9° 20' N., Long. 98° 20' E.*).
- 15 The description and directions for Takua Pa inlet must be used with great caution as they were compiled in 1876 and changes may have taken place; it is also reported that it is not safe for vessels of moderate size to attempt to enter, as the channel, which is narrow and difficult, is steep-to, the depths decreasing abruptly from 6 to 20 2 fathoms (11^m0 to 3^m7). Unless possessing local knowledge, vessels should not attempt to enter this inlet.

Entrances.—Light.—The entrance to Pak Kura, the northernmost of the four entrances to Takua Pa inlet, lies between the north-eastern extremity of K_o Ra, situated about one mile south-eastward of Takua 25 Pa, the northern point of that island, and Casuarina point, about 2 miles farther south-eastward; the greater depths are on the western side of the entrance.

A light is exhibited, at an elevation of 115 feet (35^m0), from a white concrete tower, 16 feet (4^m9) in height, situated on Takua Pa.

- 30 Pak Chik (Tjik), the entrance between the southern end of K_o Ra and the northern end of K_o Phra Thong (Goh Pra Tang), is narrow, almost choked with sandbanks and rocks, and only passable by boats.

Pak Kruen, the middle entrance to the inlet, lies between the southern end of K_o Phra Thong and the northern end of an unnamed 35 island about one mile southward. Extensive sandbanks, parts of which dry 5 feet (1^m5), extend seaward from one to 1½ miles from both sides of the entrance. A bar, consisting of a large sand flat about one mile wide, over which there was a least depth of 10 feet (3^m0) in 1891, lies between 2½ and 3½ miles westward of the entrance.

40 During the South-west monsoon, there is generally a heavy swell on the bar and Pak Kura is then much to be preferred. In the channel between the entrance points the greatest depths, from 5 to 7 fathoms (9^m1 to 12^m8), are along its northern side. The sandbanks here do not change and the channels remain constant, but entry should not 45 be attempted without local knowledge.

Khlong Pak K_o (Pak Goh), the southern entrance to Takua Pa inlet, about 9 miles southward of Pak Kruen, has depths of from 2½ to 3 fathoms (4^m6 to 5^m5) for about 2 miles; the channel lies between sandbanks which are reported to be stationary. The land 50 in the vicinity of Khlong Pak K_o is densely wooded but there are numerous small creeks and at high water a large part of the country is flooded, making it little more than a mangrove swamp. During the fine season, small vessels with local knowledge may use Khlong

Chart 3052.

Pak K_o with advantage, but during the South-west monsoon, Pak Kura is the only safe entrance.

The town of Takua Pa is situated about $4\frac{1}{2}$ miles above the mouth of a creek which flows into the eastern side of Khl_ong Pak K_o about 2 miles within the entrance. 5

K_o Gah (Goh Gah) is a sandy islet, situated about one mile from the coast about $7\frac{1}{2}$ miles southward of K_o Khor (Goh Khor), situated at the southern end of K_o Phra Thong; it is surrounded by extensive sandbanks which are fronted by rocks, surrounded by depths of from 2 to 5 fathoms (3^m7 to 9^m1) and partly visible at low water. Between the island and the mainland are sandbanks with depths of only a few feet over them. There are depths of from 10 to 12 fathoms (18^m3 to 21^m9) about 5 miles westward of K_o Gah, but depths of 5 and 6 fathoms (9^m1 and 11^m0) have been reported in that vicinity. 10 15

Anchorage.—There is anchorage, for a vessel of 12-foot (3^m7) draught, about half a mile northward of Feather tree, which is situated on the northern side of Elbow point (*Lat.* $9^\circ 02' N.$, *Long.* $98^\circ 20' E.$), on the eastern side of the inlet, opposite Pak Kruen and about 4 miles eastward of K_o Khor. 20

Vessels of less than 12-feet (3^m7) draught go up the estuary towards Takua Pa, situated about 9 miles southward of Elbow point, and anchor about $1\frac{3}{4}$ miles southward of Elbow point, close to a small creek, through which boats can go up to Takua Pa town, thereby saving considerable time. This creek is very shallow, and at low 25 water passable only by small boats.

Tidal streams.—The stream seldom runs at a rate of more than 4 knots, in the upper part, and from 2 to 3 knots, in the lower part of the estuary. In Pak K_o the in-going and out-going streams are regular, and run at a rate of from 2 to 3 knots. 30

Directions.—Beacon.—Approaching Pak Kura, vessels should steer 091° for Takua Pa (*Lat.* $9^\circ 16' N.$, *Long.* $98^\circ 19' E.$), to avoid the 3-fathom (5^m5) shoal situated about 3 miles west-north-westward of it, and round the northern end of K_o Ra at the distance of half a mile, in depths of from 5 to 6 fathoms (9^m1 to 11^m0). From the 35 north-eastern point of K_o Ra, they should steer 198° , keeping close along the island side, and passing about 2 cables distant from a projecting bluff on the eastern side of K_o Ra, in order to avoid a sand spit which extends from the eastern side of the passage to within 3 cables of this bluff; on this course the depths are about 4 or 5 fathoms 40 (7^m3 or 9^m1).

When past the bluff, vessels should steer 181° for about $1\frac{1}{2}$ miles, and then keep gradually round south-eastward to the middle of the passage; in this reach depths of 3 fathoms (5^m5) at high water have been reported. Near the end of this reach and southward of two 45 small islands, there is a large group of fishing stakes on the mainland side; when these stakes are sighted, steer for them, to clear a sandbank which extends from the eastern point of K_o Phra Thong and a smaller bank, with depths of $2\frac{1}{4}$ fathoms (4^m1) over it, which is situated 3 cables north-eastward of it. 50

When close to the fishing stakes, vessels should steer about 225° , keeping in mid-channel, and pass eastward of a black beacon, surmounted by a cone, off Macaulay point, which is situated about one mile north-westward of Elbow point; the beacon marks a patch

Chart 3052.

of broken ground over which, in some places, is a depth of only 9 feet (2^m7); on this course the depths are from 4 to 5 fathoms (7^m3 to 9^m1). In passing the beacon, the mainland side of the channel should not be approached closely, as a sandspit, which dries, extends well into the channel north-eastward of Feather tree.

Approaching Pak Kruen from seaward, the sandbanks off the entrance points cannot be seen, and this entrance should not be attempted without local knowledge.

- 10 During the North-east monsoon, Pak Kruen is safe and easy for vessels of shallow draught proceeding to sea; from between the sandbanks vessels should steer 248° to sea.

Vessels entering Pak Kō should approach with the low casuarina tree point on the southern side of the entrance bearing 113° between the sandbanks; inside the bar, the depths increase to 5 and 6 fathoms (9^m1 and 11^m0) for a short distance, whence it becomes narrow and shallow.

PAK KQ TO HLÆM TAM CHQK.—Coast.—Dangers.—

- Hlæm (Lem) Hua Krung Noi is a low sandy point about 3½ miles southward of Pak Kō; a coral reef, which dries, extends about three-quarters of a mile westward of the point. Hlæm Hua Krung Hyai (Lem Hua Krung Yai), about 4½ miles south-south-westward of Hlæm Hua Krung Noi and backed by high trees, is another low and sandy point; a coral reef which dries surrounds the point and extends about three-quarters of a mile northward and southward, and half a mile westward, from it. From Hlæm Hua Krung Hyai, the coast trends southward for about 7 miles to Hlæm (Lem) Hin Bai, a bluff and wooded headland rising to an elevation of 305 feet (93^m0); this stretch of coast is low in the northern part and backed by high hills which gradually approach the coast, reaching it at Hlæm Hin Bai, whence they again recede southward of the point. About midway between Hlæm Hua Krung Hyai and Hlæm Hin Bai, and near the mouth of a small river, is Ban Bang Niang, a village with tin mines in the vicinity, from which lights, which are visible seaward, are occasionally exhibited. Krung Nork, an isolated coral reef which dries 2 feet (0^m6), lies about one mile offshore westward of Ban Bang Niang, and foul ground extends as much as three-quarters of a mile offshore between this reef and Hlæm Hin Bai (*Lat. 8° 37' N., Long. 98° 14' E.*). *Charts 3052 and 842.*

- 40 Hlæm (Lem) Ao Kham, about 2 miles south-south-westward of Hlæm Hin Bai, is the western entrance point of Khlong Thung Ma Phrao, *see* page 483, and has on it a round-topped hill, 275 feet (83^m8) high, and is fronted by a drying coral reef which extends about a quarter of a mile seaward and is steep to on its northern and eastern sides. It is the northern extremity of a bold peninsula which rises to an elevation of 545 feet (166^m1) at Khao Tam Chok, about 2 miles southward of the point; Hlæm (Lem) Tam Chok, about a quarter of a mile south-westward of the summit of Khao Tam Chok, is the western extremity of the peninsula. This peninsula is isolated from, and is considerably westward of, any other high land in the vicinity, and it is the only point between Kō Ra and Kō Phuket (Chart 842, page 485) which can be readily identified.

Ao Ko Hlak (Ao Kaulak), a bay between Hlæm Hin Bai and Hlæm

Charts 830, 70.

Charts 3052 and 842.

Ao Kham, is divided into two parts by a reef which dries in patches and extends about half a mile westward from a sandy point about one mile south-south-eastward of Hlæm Hin Bai. Hin Khi Nok, a rock, 12 feet (3^m7) high, lies near the outer end of this reef and the bight northward of the reef is foul for a distance of about one mile offshore; foul ground also extends about 7 cables offshore for about half a mile southward of the reef. A shallow flat, on which the depths are less than 3 fathoms (5^m5) and on which are numerous fishing stakes, fronts the southern end of Ao Ko Hlak, extending about three-quarters of a mile offshore. An isolated rock, with a least depth of 5 feet (1^m5) over it, lies about three-quarters of a mile south-westward of Hlæm Hin Bai.

Tidal streams.—**Currents.**—During the North-east monsoon, the current off the coast between Kō Ra and Hlæm Tam Chōk appears to be variable, setting in either a general northerly or a general southerly direction. It usually sets in the same direction for considerable periods, and there is no apparent reason for the periodical changes in direction. It does not seem to have any connection with the wind, and frequently sets northward during and after periods of moderate northerly winds. The current is nearly always stronger than the tidal stream, so the direction of the set remains constant with strength varying and usually not more than a knot, but the combined effect of current and tidal stream may on occasions reach nearly 2 knots.

Khlōng Thung Ma Phrao.—**Anchorage.**—**Directions.**—Khlōng Thung Ma Phrao (Khlōng Tub-Moh) is the common estuary of several rivers, which enters the southern end of Ao Ko Hlak and is of considerable size; the peninsula, of which Hlæm Ao Kham (*Lat.* 8° 35' N., *Long.* 98° 13' E.) is the northern extremity, forms the left bank of the estuary. It is about half a mile wide at the entrance, with depths of over 3 fathoms (5^m5) in a fairway about 2 cables in width. A middle ground, with a least depth of 10 feet (3^m0), lies on a bar about three-quarters of a mile within the entrance. A channel with depths of from 6 to 10 fathoms (11^m0 to 18^m3) runs along the western side of the river for about a mile, and from there the bar can be crossed, in a depth of 17 feet (5^m2), and depths of from 3 to 4½ fathoms (5^m5 to 8^m2) can then be found in mid-channel to a point about 3 miles above the entrance, where the river bifurcates.

Small vessels with local knowledge can obtain well-sheltered anchorage, in a depth of about 6 fathoms (11^m0), muddy bottom, about half a mile inside the entrance.

Vessels should approach the river steering 135° and the entrance should on no account be opened until southward of Hin Khi Nok. The north-eastern extremity of the peninsula should then be passed steering 190° at a distance of not more than one cable.

Chart 3052.

OUTLYING ISLANDS SOUTHWARD OF Kō SINDARAR (*continued from page 471*).—Kō (Goh) Tasai, situated about 18 miles southward of Kō Sindarar Tai, is densely wooded and is steep-to except on its eastern side where depths of 23 feet (7^m0) are found about 3 cables off a sandy beach about half a mile from the northern point of the island. Kō Tasai attains an elevation of 742 feet, (226^m2)

Charts 830, 70.

Chart 3052.

at its southern end and there is a peak, 298 feet (90^m8) high, at its northern end, with another, slightly lower, between them.

K_Q (Goh) Born, about 14 miles southward of K_Q Tasai, is small and wooded; it is steep-to except northward of its western extremity, where a depth of 21 feet (6^m4) is found about 2 cables offshore. It has two distinct peaks, the eastern of which is 465 feet (141^m7) high, and the western about 150 feet (45^m7) high; at the water's edge, in the gap between the two peaks, is a prominent hole.

10 **Similan islands.**—Similan islands are a group of six islands of which K_Q (Goh) Bharngu, the northernmost island, lies about 12½ miles south-westward of K_Q Born and the group extends about 12 miles southward between K_Q Bharngu and K_Q (Goh) Huyong, the southernmost island. See view facing page 481.

15 K_Q Bharngu is 315 feet (96^m0) high and wooded. A rock, which dries 5 feet (1^m5), lies about one cable northward of its western point and there are several large and prominent boulders close off its south-eastern point; except for these, the island is steep-to.

K_Q (Goh) Similan, the largest of the group, is separated from K_Q Bharngu by a channel about 3 cables wide in which the depths are about 14 fathoms (25^m6). K_Q Similan is wooded and flat-topped and rises to an elevation of 856 feet (260^m9) near the northern end. The island is steep-to generally, but there is a small cove with a depth of 5 fathoms (9^m1) at the north-western extremity and there are small sandy coves on its eastern side.

Hin Pousar, a group of three detached rocks, from 16 to 27 feet (4^m9 to 8^m2) high and steep-to, lies about half a mile south-westward of the southern end of K_Q Similan; a rock, with a depth of 52 feet (15^m8) over it, lies about 1½ cables southward of Hin Pousar.

30 The Centre islands are two islands lying between 2 and 4 miles southward of K_Q Similan. K_Q (Goh) Pabu, the northern island, 390 feet (118^m9) high, wooded and conical, is steep-to except on its north-eastern side where depths of 2 fathoms (3^m7) extend about 3 cables offshore. K_Q (Goh) Miang, the southern island, 420 feet (128^m0) high, is wooded and flat-topped; a rock which dries 5 feet (1^m5) lies close off the northern extremity of the island and on the eastern side is a small sandy cove with a depth of 4 fathoms (7^m3). Two islets lie on a reef about 2 cables off the north-eastern end of the island, with a depth of 37 feet (11^m3) in the channel between; the western islet is 159 feet (48^m5) high and wooded, and the eastern is 66 feet (20^m1) high and rocky. With the above-mentioned exceptions, the island is steep-to.

K_Q (Goh) Payan, about 3 miles south-south-eastward of K_Q Miang, is a bare, conical rock with scrub on the summit; it is 138 feet (42^m1) high and steep-to. Hin Payan, a group of rocks which is steep-to, lies about 6 cables east-south-eastward of K_Q Payan (*Lat.* 8° 31' N., *Long.* 97° 40' E.) with a depth of 10½ fathoms (19^m2) in the channel between them. The main group of rocks has several drying heads and two rocks about one foot (0^m3) high, and about 2 cables farther east-south-eastward is an isolated rock which dries 9 feet (2^m7).

K_Q (Goh) Payang, 414 feet (126^m2) high and wooded, lies about one mile south-westward of K_Q Payan, with depths of from 24 to 36 fathoms (43^m9 to 65^m8) between; it is steep-to.

K_Q (Goh) Huyong lies about half a mile southward of K_Q Payang,

Charts 842, 830, 70.

The Donkey's Ears.



Pulau Tonton. Conspicuous double
peak of E. tangent
of Thane islet, bearing
149°, distant 4 m.

Akha Barit.
Sims reef beacon.

Pulau
Besin.

Pulau
Jungs.

Ko Chang.

Leading marks for the northern approach channel to Pakchan river.

(Original dated 1930.)

To face page 481.



Ko Huyong. *Ko Payang,*
bearing 242°, distant 9.3 m.

Ko Miang. *Ko Pabu.* *Hin Pousar* *Ko Similan.* *Ko Bhangu.*

Similan islands from east-north-eastward.
(Original dated 1937.)



Ko Racha Hyai,
bearing 067°, distant 17 m.

Ko Racha Noi,
bearing 087°, distant 14 m.

Islands southward of *Ko Phuket* from westward.
(Original dated 1884.)

Chart 3052.

with depths of from 19 to 26 fathoms (34^m7 to 47^m5) between ; it is wooded and has two rounded peaks, 362 and 360 feet (110^m3 and 109^m7) high, respectively. The island is steep-to except on its north-eastern side, where a coral reef fronting a sandy beach extends about one cable offshore. 5

Charts 3052 and 842.

HLÆM TAM CHØK TO HLÆM PHRA CHAO.—Coast.—
Offshore depths.—Between Hlæm Tam Chøk (page 482) and Hlæm Pak Phra, the northern entrance point of Chøng Pak Phra (Chong Parkprah), about 22 miles south-south-eastward, the coast consists of sandy beaches with trees down to the water's edge, backed by high wooded hills ; there are a few villages on this stretch of coast. 10

Hin Talum Phuk (Hin Talumpuk), a group of rocks about 6 feet (1^m8) high, with depths of from 4 to 5 fathoms (7^m3 to 9^m1) close-to, lies about 7½ miles northward of Hlæm Pak Phra and about half a mile offshore ; two smaller rocks lie close inshore about half a mile northward of the group. 15

Hlæm Pak Phra is rendered distinctive by a group of high trees and a conical hill about 200 feet (61^m0) high just within the point ; about 2½ miles northward of it is Kò Pilai, a small hill close to the coast which is the only coastal hill between Hlæm Tam Chøk and Hlæm Thrai (Lem Sai), about 7½ miles southward of Hlæm Pak Phra, but it is not easily identified. 20

Between Hlæm Tam Chøk and Hlæm Pak Phra, the offshore depths gradually decrease towards the coast to 6 or 8 fathoms (11^m0 or 14^m6) about half a mile offshore, but this coast should not be approached within a distance of 3 miles, as it has not been examined. 25

Chart 842.

Western coast of Kò Phuket.—Light.—From Hlæm Pak Phra, the coast trends southward for about 26½ miles to Hlæm Phra Chao and forms the western side of Kò Phuket (Goh Puket), an island which is separated from the mainland by Chøng Pak Phra, a strait much used by junks. Chøng Pak Phra is described in the Malacca Strait Pilot. 30 35

There are several bays on the western coast of Kò Phuket, none of which affords any protection during the South-west monsoon. The northern part of this coast, with the exception of a small area in the vicinity of Hlæm Thrai, is low, wooded and backed by hills of moderate elevation. The southern part rises steeply to a mountain range from about 860 to 1,700 feet (262^m1 to 518^m2) high, thickly wooded and sloping gradually northward and southward. 40

The whole of the western coast of Kò Phuket is steep-to, with depths of 10 or 12 fathoms (18^m3 or 21^m9) close offshore. Kò Wæo (Lat. 8° 02' N., Long. 98° 15' E.), two islets, the higher of which is 50 feet (15^m2) high, lie close together about 2½ miles south-south-westward of Hlæm Thrai, and about one mile offshore. 45

Kò Kæo Hyai, an islet with two white pagodas on its north-western point, lies about three-quarters of a mile southward of Hlæm Phra Chao, the southern extremity of Kò Phuket ; there is a safe passage, with depths of from 8 to 10 fathoms (14^m6 to 18^m3), between this islet and Hlæm Phra Chao. 50

Kò Kæo Nòi (Goh Keo Noi), an islet covered with trees and smaller

Charts 830, 70.

Chart 842.

than, but of the same elevation as, K_Q Kæo Hyai, lies about half a mile southward of the latter islet. A light is exhibited, at an elevation of 167 feet (50^m9), from a white concrete tower, situated on the summit
5 of K_Q Kæo N_Qi.

The eastern coast of K_Q Phuket and the coast of the mainland eastward and south-eastward of it is described in the Malacca Strait Pilot.

Off-lying islands.—K_Q Racha Hyai (Goh Raja Yai) and K_Q
10 Racha N_Qi (Goh Raja Noi) are two islands, lying between 8 miles south-south-eastward and 16 miles southward of K_Q Kæo N_Qi lighthouse, *see* view facing page 481. The south-western part of K_Q Racha Hyai rises to an elevation of 1,064 feet (324^m3), but its north-eastern part is low. Gulnare cove, at the north-eastern end of the island, has a
15 depth of 9 fathoms (16^m5), sand, in the middle. There is a small inlet at the north-western end of the island into which a stream flows during the rainy season.

K_Q Racha N_Qi, the northern end of which lies about 4 miles south-south-westward of K_Q Racha Hyai, are two densely wooded and steep-to
20 islands which are nearly connected by a reef. The northern island is 579 feet (176^m5) high, and has a rock lying close off its northern extremity; the southern island is of nearly uniform height with a reef extending about one cable from its southern end.

There are heavy overfalls between K_Q Racha Hyai and K_Q Racha
25 N_Qi.

Current.—Tidal streams.—Southward of K_Q Phuket the current sets north-westward during the North-east monsoon and south-eastward during the South-west monsoon, but after strong westerly or west-south-westerly winds, the current southward of K_Q Racha N_Qi
30 (*Lat.* 7° 30' N., *Long.* 98° 20' E.) sets eastward.

In the channels between the islands lying off the southern coast of K_Q Phuket the tidal stream sets eastward with the rising tide and westward with the falling tide, at a rate of from one to 3 knots.

Charts 830, 70.

APPENDIX I

LIST OF PORTS AVAILABLE FOR UNDER-WATER REPAIRS, with details of Largest Dry or Floating Dock or Patent Slip at each Port.

NAME OF PORT AND TYPE OF DOCK, ETC.	Length from bilge of caisson or mitre post of gates at		Maxi- mum length of keel blocks	Breadth of entrance at		† Distance { Chart datum level of above (+) below (-)	Springs			FLOATING DOCKS, PATENT SLIPS, &c.			REMARKS
	Coping head	Floor head		Coping	MHWS level		Sill	Blocks, at		Maximum depth over blocks		Lifting power	
			(1)*			(2)*		(4)†	(5)†	(6)	Entrance		Head
		Feet	Feet	Feet	Feet	Feet	Feet	(7)	(8)	(9)	(10)	(11)	(12)
COLOMBO :													
Dry dock, Outer	705.6	702.6	650.0	85.0	83.8	+ 30.0	+ 30.25	+ 29.25	2.2	—	—	—	Length can be increased by 14.2' by placing caisson in outer stop. Outer and inner docks cannot be used as one dock.
" Inner	368.75	365.75	351.0	54.0	54.0	+ 20.0	+ 20.25	+ 19.75	—	—	—	—	
MADRAS :													
Patent slip . . .	532.0	221.0	—	—	24.0	—	—	—	3.5	4.25	15.0	1,150	Vessel 194' × 34' × 15.25 has been taken.
COCANÁDA :													
Dry dock; . . .	135.0	122.5	108.0	30.0	30.0	+ 2.0	+ 0.2	+ 0.2	4.7	—	—	—	Can take vessel 130' × 27' × 4'.
VIZAGAPATAM :													
Dry dock. . .	389.5	384.75	320.0	60.5	60.5	+ 14.5	+ 10.5	+ 10.5	5.5	—	—	—	Limiting dimensions of vessel that can be docked— 370' × 50' × 12.5'.

* In the case of Floating Docks, Patent Slips, &c., Column (1) = Extreme Length. Column (2) = Length on Blocks or Cradle.

† In the case of Floating Docks, Column (4) = Breadth at Top. Column (5) = Breadth at bottom of Dock.

‡ In order to find the depths on Sill, &c., the quantities in columns (6), (7) and (8), should be applied according to sign to the predicted or calculated height of tide as obtained from the Admiralty Tide Tables.

LIST OF PORTS AVAILABLE FOR UNDER-WATER REPAIRS, with details of Largest Dry or Floating Dock or Patent Slip at each Port—continued.

NAME OF PORT AND TYPE OF DOCK, ETC.	Length from bilge of Caisson or Mitre Post of gates at		Maxi- mum length of keel blocks	Breadth of Entrance at		† Distance {below (+) above (-) Chart datum level of	Springs	FLOATING DOCKS, PATENT SLIPS, &c.				REMARKS.							
	Coping head	Floor head		Coping	MHWS level			Sill	Blocks, at		maximum depth over blocks		Lifting power						
									(1)*	(2)*	(4)†			(5)†	(6)	Entrance	Head	Forward	Aft
	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Tons							
PORT BLAIR : Patent slip . . .	—	100·0	—	—	—	—	6·5	6·0	—	—	—	80	Can take vessel 100' long. Reported un-ser- viceable (1949).						
BASSEIN : Patent slip . . .	220·0	14·0	—	11·5	—	—	—	4·0	4·0	4·0	15								
RANGOON : Dry dock. . .	242·0	218·0	208·0	—	49·75	—6·3	18·8	—	—	—	—	—	Sill is 4 ft. above bottom of dock. Depth on sill at M.H.W.S. is 12·5 ft.						
MANDALAY : Floating dock . .				No information available.															
MOULMEIN : Patent slip . . .	370·0	105·0	—	—	16·0	—	—	—	—	—	—	100	Largest vessel that can be taken—96 ft. in length.						

* In the case of Floating Docks, Patent Slips, &c., Column (1) = Extreme Length. Column (2) = Length on Blocks or Cradle.

† In the case of Floating Docks, Column (4) = Breadth at Top. Column (5) = Breadth at bottom of Dock.

‡ In order to find the depths on Sill, &c., the quantities in columns (6), (7) and (8), should be applied according to sign to the predicted or calculated height of tide as obtained from the Admiralty Tide Tables.

APPENDIX II

LIST OF PRINCIPAL PORTS, SHOWING PARTICULARS OF DEPTHS, ETC.

PORT	Depth below Chart datum level		Rise of tide		REMARKS
	In channel of approach	In anchorage	Spgs.	Nps.	
			Feet	Feet	
Colombo : Western entrance Northern entrance	38 feet 33 feet	} 36 feet	2.2	1.5	Vessels of 33 feet draught can be accommodated at moorings, and 34 feet is the maximum draught admitted.
Galle	6 fms.	3½ to 6½ fms.	2.0	1.5	Vessels up to 500 feet in length and 30 feet draught can be accommodated.
Trincomalee . .	Deep	11-13 fms.	1.8	1.5	
Madras	34 feet	32 feet	3.5	2.2	Vessels of 31 feet draught can be accommodated at moorings and from 25 to 30 feet draught at jetties.
Calcutta	14 feet	5-8 fms. (Sāgar roads)	17	12.5	Vessels of 28 feet draught can ascend the Hooghly as far as Calcutta at springs, and of 26 feet draught at neaps.
Chalna anchorage (Pussur river)	2½ fms.	5 fms.	10.0	7.3	Vessels of 23 feet draught can ascend the Pussur river as far as Chalna at neaps.
Akyab : Outer bar . . Inner bar . .	25 feet 18 feet	7-8 fms.* 16-24 feet†	} 7.8	5.7	* Outer anchorage. † Inner anchorage.
Kyaukpyu harbour	Deep	9-10 fms.	10.5	7.0	
Ramree harbour .	6 fms.	3½ to 10 fms.	9.0	6.5	
Temple sound . .	Deep	10-12 fms.	8.0	5.0	
Port Anson . .	Deep	9-10 fms.	7.0	5.0	

LIST OF PRINCIPAL PORTS, SHOWING PARTICULARS OF
DEPTHS, &c. (*continued*)

PORT	Depth below chart datum level		Rise of tide		REMARKS
	In channel of approach	In anchorage	Spgs.	Nps.	
Port Mouat. . .	6 fms.	4-5½ fms.	5·0	—	
Port Cornwallis . .	Deep	6-8 fms.	8·0	5·5	
Stewart sound . .	Deep	10-14 fms.	8·0	6·0	
Port Meadows . .	Deep	9-10 fms.	7·0	4·5	
Port Blair : Northern entrance	Deep	} 7-8 fms.	6·5	4·5	
Southern entrance	27 feet				
Nancowry harbour : Eastern entrance	6 fms.	} 12 fms.	6·0	4·0	
Western entrance	Deep				
Diamond island : Western approach	4½ fms.	} 4½-5 fms.	7·8	6·0	
South-eastern approach	Deep				
Bassein river and port	20 feet	17-25 feet alongside jetties	7·7	6·0	The maximum draught for the port is 26 feet ; vessels of over 450 feet are recommended not to use the port.
Rangoon . . .	16 feet	3½-10 fms.	18·8	14·3	There are depths of from 17 to 34 feet alongside the wharves. A vessel of 30 feet draught has visited the port.
Moulmein . . .	Subject to continuous change	19-35 feet	13·5	8·0	Usually available to vessels of 23 feet draught at springs and of 13 feet draught at neaps. 11-14½ feet alongside jetties.
Mergui harbour. .	11 feet	3½ to 7 fms.	17·5	12·0	There is a depth of 10 feet alongside the Main wharf.

APPENDIX III

LIST OF SPOTS SUITABLE FOR MAGNETIC OBSERVATIONS

Place.	Lat., Long.	Position.
COLOMBO . .	6° 54' 17" N. 79° 52' 15" E.	In the grounds of the Observatory, 108 feet from the south-western fence, 164 feet south-westward of the south-western corner of the office building; marked by a cement block, 5 inches square, with "C.I.W. 1911" inscribed on top. North-western corner of lunatic asylum bears 235° 40'; a small white upright over the east gable of the Surveyor-General's bungalow, 357° 26'; and the nearest corner of the office building, 032° 07'.
GALLE . .	6° 02' 00" N. 80° 12' 00" E. (approx.)	About 220 yards southward of the race course pavilion, and situated on the lower rampart of Galle fort, on the western side and inner corner of the Sun bastion; marked by a stone embedded in the rampart. The largest cross on the Roman Catholic church bears 324° 15' 53", and the pivot of the hands of the clock on the clock tower in the fort, 255° 55' 50".
PERAMBŪR . (Madras)	13° 06' 40" N. 80° 15' 00" E.	At the southern end of the dry bed of a large tank southward of Perambūr railway station; marked by a concrete pillar, on which is inscribed "G.T.S. Magnetic station."
PORT BLAIR .	11° 40' 00" N. 92° 44' 00" E. (approx.)	On the high ground northward of Navy bay, about 40 yards north-westward of a masonry well near the road between Navy bay and Phoenix bay; marked by a concrete pillar, the top of which is flush with the ground, and on which is inscribed "M.S. 1909." The former jail on Viper island bears 260° 50', and the masonry well 126° 30'.
AKYAB . .	20° 08' 06" N. 92° 53' 37" E.	On the north-eastern part of a large maidan, about 250 yards due west of the church and on the northern side of an old mango tree. The nearest telegraph post bears 338° 06', and a large banyan tree near the road, 014° 04'.
MOULMEIN .	16° 29' 40" N. 97° 37' 30" E.	On the race course about 400 yards northward of the jail; marked by a concrete pillar, 6 inches high, on which is inscribed "G.T.S. Magnetic station." The golden pagoda on a hill bears 140° 47', and the northern minaret of a mosque, 235° 48'.

INDEX

	Page		Page
A peak	416	Alexandra channel	304
A peak, False	416	Alexandra river	22
Aberdeen village	338, 342	Alfred point	357
Active spit	256	Alfrey shoal	356
Adam's bridge	170	Alguada reef	300, 365
Prohibited anchorage	170	Light	300
Adam's peak	1, 91, 111	Tidal streams	301
Adams point	280	Alice island (Warrington strait)	459
Adināth bāzār	261	Alice island (Whale bay)	457
Adirampatnam	6, 164	Allamparwa fort	184
Anchorage, light	164	Allanmyo cotton mill	390
Admiralty House pier	149	Allan's island	441
Lights	150	Allen patches	315
Adyar river	186	Allen peak	416
Agandu ridge	267	Alligator head	297
Agra rock	212	Alligator rock (Bentinck route)	449
Ahlone shoal, beacon	382	Alligator rock (Ceylon)	139
Ahlone wharf	383	Alligator rocks	288
Ahtugyi taung	296	Alon village	396
Ahungalla point	105	Alphee shoal	136
Air lights	37	Alu gala	110
Akasachetiya	128	Alut gala	103
Akauk taung	387	Alut ground	114
Akha Barit	472	Alutgama station	105
Akorale point	107	Amaduwa point	129
Akra, tidal signals	240	Amanām hill	211
Akurala point	107	Amarāpura village	394
Akyab district	15	Amazon point	369
Akyab, Port of	269	Ambalangoda rest house	107
Anchorages	272	Ambalangoda town	106
Climatic table	79	Ambalangoda village	107
Directions, prohibited anchor- age	273	Amelia crossing	403
Entrance	270	Amherst district	18
beacon, light, light-buoy	270	Amherst village	399
Inner bar, buoys	271	Climatic table	85
Inner dangers, buoyage	271	Signal station	400
Light	270	Amie island	445
Off-lying danger	270	Ammapatam	175
Outer bar, buoy	270	Ampalam village	212
Pilots	272	Ampat, Pulau	459
Port facilities, quarantine	274	An chaung	15, 276
Storm signals, town	274	An gala	115
Tides and tidal streams	272	An town	276
Wharves and jetties	273	Analativu, obelisk	166
Winds and weather	274	Anchoring creek	402
Ala gala	110	Andaman island, Little	345
Aladdin islands	469	Andaman island, Middle	310
Alamparai fort	184	Eastern side	327
Albany, Cape	359	Western side	310
Alcock, Point	345	Andaman island, North	307
Aledeing taung	282	Eastern side	319
Ale-Hmān peak	457	Western side	307
Alexander rock	369	aspect	307
		off-lying islands and dangers	308

	Page		Page
Andaman island, South	314	Athārabanki river	244
Eastern side	342	Atlas rock	132
Western side	314	Attangarai	174
Andaman islands	21, 305	Attupella	107
Caution	22	Auckland bay, anchorage	437
Currents	24, 25	Auk Bok	417
Off-lying banks	305	Auriol island	470
Outlying islands and banks	346	Austen harbour	310
Physical features	21	Austen strait	310
Production and trade	21	Ava, bridge	394
Ports	22	Ava point	156
Andaman, Port	311	Aveline hill	447
Andaman strait	311, 335	Aves island	325
Eastern entrance	336	Aves point	325
Western entrance	311	Aw, <i>see</i> proper name	
Andamban malai	157	Awgyi chaung, beacon	413
Anderson island	311		
Anderson rock	327		
Andrew bay	292		
Anchorage	293	Babeswal temple	217
Caution, light	292	Babungala point	105
Andromeda point	315	Baby island (Maunmagan group)	418
Angala rocks	108	Baby island (Port Anson)	313
Anin chaung	408	Back bay (Port Cornwallis)	321
Anne island	448	Back bay (Trincomalee)	155
Anchorage	449	Anchorage, light	156
Anson, Port	22, 312	Back Bay reef	322
Anchorage, directions	313	Backergunge district	250
Approaches	311	Bacon bay, anchorage	326
dangers	312	Bada, Pulau	463
Antinous islet	317	Badar clump	264
Anvil rock	397	Bagang, Pulau	459
Anyinma island	427	Bāghkhāli river	261
Anyinpo island	427	Anchorage	263
Ao, <i>see</i> proper name		Bāhuda river	215
Ao Kham, Hlām	482	Bailey island	442
Apau-ye-kyun	292	Bain island	450
Api islet	345	Baitarani river	10, 227
Arakan division	14	Bakarganj district	250
Arakan Yoma range	16, 292	Baker rocks	138
Arangala point	106	Bakud creek	223
Arasalār river	178	Balapitiya point	106
Argo flat	250	Balari, tidal signals	240
Ariel ledge	344	Balasore district	11
Armagon old lighthouse	192	Balasore road	229
View	192	Anchorage, directions	229
Armagon shoal	192	Tidal streams	230
Armagon village	192	Balasore town	11, 230
Arong village, anchorage	348	Port facilities	230
Arthur channel	335	Balat, Pulau	459
Aru, <i>see</i> proper name		Baleshwar river	249
Arugam bay	134	Baleswar temple	220
Ashby rocks	369	Baleswur temple	220
Tide gauge	370	Balfour reef, buoy	329
Asin chaung	414	Bālijori obelisk	220
Asin hill	414	Balisahi point, beacon	225
Asin pagoda	414	Balu, Pulau	463
Asirgarh shoal	267	Baluchistan hills	3
Asses' Ears	134	Bambalapitiya	101
Assia peak	10	Bamboo Flat bay	340
Asun pagoda	414	Bambri rocks	124
Atalahua point	122	Ban, <i>see</i> proper name	
Atalanta bay	322	Ban Bang Niang village	482
Atalanta point	338	Bandarban	14
Beacon	339	Bang, <i>see</i> proper name	
Lights	338	Bang Bane, Khlong	478
Ataran river	18	Bang Ben, Khlong	478
Atēma kyun	418	Bang Chak, Khao	473, 478
Atet Bok	418	Bāngaduni island	246

	Page		Page
Bāngaduni river	246	Bayne point	320
Bāngaduni sand	246	Bazaar rock	156
Bāngara river	249	Beacon hill	275
Bānkurā	11	Beacon island	282
Banlin river	473	Beacon, light	283
Banrim river	473	Beacon rock (Batticaloa)	136
Baragua flats	371	Beacon rock (Trincomalee)	141
Baragua point	371	Beauchamp patch	318
Barapanga river	246	Beauchamp reef	320
Barata bay	346	Beaumont's gut	237
Bārātala river	239	Light-vessel	238
Baratang island	329	Beba, Pulau	463
Barbara island	450	Belikatu Wawa, buoy	113
Barberyn light	104	Bell passage	474
Bare islet	463	Bendi creek	213
Barisāl	244, 250	Anchorage	214
Storm signals	244	Bendi hills	214
Barisāl river	250	Bengal, East, <i>see</i> East Bengal	
Barkal rapids	14, 254	Bengal point	464
Barkeley point	322	Bengal, West, <i>see</i> West Bengal	
Barker point	278	Bengala village, anchorage	352
Barn hill	424	Bengara	267
Barn island (Research strait)	275	Bengaya	267
Barn island (Whale bay)	457	Bennett island	311
Baroni rock, light-buoy	366	Bennington hill	136
Barons Cap	138	Bentinck island	446
Barren island, anchorage	346	Anchorage	446, 447
Baruva, Port of	9, 214	Bentinck point	408
Anchorage	215	Bentinck route	443
Beacons, light	214	Directions	451
Baruva village	214	North-western approach	440
Barwell island	464	islands and dangers	440
Basham island	442	Tidal streams	451
Basin island	445	Western approach	441
Bassein creek	17, 372	islands and dangers	441
Bassein district	16	Bentinck sound	409
Bassein river	16, 365	Anchorage, directions	409
Approaches	365	Tidal streams	409
anchorage, directions	366	Bentota ganga	105
off-lying dangers	365	Beresford channel	355
pilotage, tidal streams	366	Berkeley group	325
storm signals	367	Bernard island	450
Bar	368	Bertie island	437
channel, buoyage	368	Beruwala bay, landing	103
Beacons, buoys	369	Beruwala point	102
Pilots, storm signals	371	Beruwala village	103
Port facilities, quarantine	370	Besin, Pulau	472
Tide gauges, town	370	Best clump	265
Basses reef, Great, light	130	Bezwada	196
Basses reef, Little	131	Bhadra reef	457
Currents	133	Bhadra rock	458
Light	132	Bhairab river	244
Basses ridge, Great	130	Bhamo town	385, 395
Basses ridge, Little	131	Bhāngārā river	249
Bataina gala	109	Bhārgavi river	10, 218
Bath Bun island	411	Bharngu, Kō	484
Battery point (Moulmein harbour)	405	Bhubaneswar town	10
Battery point (Nancowry harbour)	357	Bidda river	245
Batti Malv island, view	350	Biddy island	445
Batticaloa lake	137	Biddy rock	445
Batticaloa roads	136	Bideipur village	229
Anchorage, light	136	Bidya river	245
Directions, life-saving	137	Bidyā River point	245
Winds	88, 137	Bidyadhari river	245
Batticaloa town	137	Big rock	288
Baung kyun	288	Bilin hills	18
Bavanapadu village, beacon	213	Bilin river	18
Bawmi bay	296	Bilugyun channel	402
Bawmi chaung	296	Bilugyun island	18, 399

	Page		Page
Bilugyun sands	402	Boom cove	149
Bimlipatam port	9, 210	Bopung	321
Anchorage, beacon	210	Bores	30
Light, port facilities	210	Born, Kō	484
Storm signals, town	210	Boronga point	275
Bingham rock	275	Boulder point	156
Binnacle rock	303	Boulder rock	467
Birbhūm	11	Bowen shoal	463
Bird rocks	454	Bowers island	431
Birds Nest islands	426	Bowers reef	427
Birds Nest rocks	470	Bowman passage	280
Birds nest rocks	418	Boyut island	462
Black hill	282	Braganza ledge	312
Black point	156	Brāhmāni river	10, 224
Black rock (Bentinck route)	449	Brahmaputra river	12, 251
Black rock (Round cape)	299	Brand New island	402
Blackwood harbour	192	Breaker point	311
Anchorage, directions	193	Brennus shoal	136
Blair bay	323	Brigade creek	341
Blair point	340	Briton point	332
Blair, Port	22, 338	Broken point	296
Climatic table	81	Broni Mohan creek	222
Directions	341	Brook point	311
Entrance channels	338	Brooker's rock	318
beacons, lights	338	Brooking Street wharf	383
Inner part	340	Tide gauge	383
anchorages	341	Brother island, North	344
buoys	340	Brother island, South	344
Outer part	339	Brother rock, North	470
northern side	339	Brother rock, South	470
southern side	340	Brothers islands (Karathuri bay)	459
Port facilities, settlement	342	Brothers islands (Little Andaman island)	344
Storm signals	342	Brougham shoal	294
Blair reef, buoy	340	Brown hill	282
Block jetty	96	Brown island	466
Bloomfield rock, buoy	114	Brown point	326
Blue mountain	15	Brown rock	431
Bluff cape	293	Brown Rock point	139
Bluff, Cape	314	Brown shoal	145
Bluff island	312	Browning island	475
Bluff point (Amherst coast)	407	Brown's hill (Ceylon)	122
Bluff point (Bentinck island)	446	Brown's hill (North Andaman island)	308
Bluff point (North Andaman island)	308	Bruer island	470
Blundell island	429	Brunette island	441
Blunt island	460	Brush island	322
Boar point	247	Buchanan passage	311
Light	248	Bucho, Pulau	459
Boat island	317	Buckingham canal	7, 194
Boat rock (Bokpyin chaung)	458	Buda, Pulau	463
Boat rock (Great Nicobar island)	364	Budarā beacon	225
Bogale river	17, 365	Budge Budge	237
Bok Ye-gan	418	Jetties	242
Bokalossawa gala	115	Buffaloes, The	298
Bokpyin chaung, anchorage	458	Bugwe kyun	297
Bokpyin village	458	Buktaung	419
Bold promontory	461	Bulcherry sand	244
Bolo rock, Great	120	Bulet-aw	461
Bolo rock, Little	120	Bumila creek	345
Bolt point	134	Anchorage, tidal stream	345
Bolton shoal	309	Bundala village	128
Bombay shoal, buoy	280	Buona Vista orphanage	111
Bombuwela	102	Buoyage systems	34
Bomford island	441	Burdwān division	11
Bonie bay	296	Burhābalang river	11, 229
Bomie river	296	Caution	230
Bompoka island	352	Burgess rock, light-buoy	368
Bond harbour, anchorage	320	Burleigh rock	355
Bonington settlement	325		

	Page		Page
Burma	14	Carew island	449
Currency	15	Carnac channel	459
Government, products and in-		Carnac island	459
dustry	14	Carpenter shoals	293
Weights and measures	14	Cash island	470
Burne island	430	Castle bay, anchorage	351
Burne rocks	268	Castle Bay point	351
Bushby island, anchorage	449	Castle island	430
Bushby islet	473	Castle rock	405
Butawa point	129	Casuarina bay (Great Nicobar	
Butawa rock	130	island)	362
Buthidaung	266	Anchorage	362
Butterfly bend	388	Casuarina bay (North Andaman	
Button hill	294	island)	308
Button island (Amherst coast)	402	Casuarina clump	265
Button island (Bentinck route)	444	Casuarina point	478
Button island (Cheduba strait)	283	Cat and Kitten island	463
Button island, Middle	330	Catherine bluff	278
Button island, North (Diligent		Cattale	245
strait)	331	Cauveri river	5, 180
Button island, North (Moscos		Cauverypatam village	178
islands)	418	Cavendish island	408
Button island, South (Diligent		Cavern island	466
strait)	331	Celerity passage	454
Button island, South (Moscos		Celia rock	449
islands)	418	Central sand	221
Byangyi kyun	369	Centre islands	484
		Centre peak	284
		Centre Western light-float	375
Cabusa island	428	Cerberus rock	364
Cadell bay, anchorage	320	Ceylon	1
Cadell point	323	Climate, communications, cur-	
Calcutta	242	rency	3
Berthage, currents	242	Government, population	2
Climatic table	77	Physical features	1
Deratisation, port facilities	243	Ports, weights and measures	3
Lights, navigation	242	Rivers, trade and shipping	2
Radio station, Radio D.F.		West coast	91
station	243	aspect, depths	91
Tidal streams	242	Chalai gap	159
Calimere, Point	163, 176	Challenger, Mount	147
Light	163	Challitivu islet	138
Calingapatam	212	Chalna anchorage	13, 244
Calventuras	297	Port facilities, tidal streams	249
Camorta island	352	Chāndbāli	11, 227
Camp bay	326	Anchorage, port facilities	228
Campbell bay	364	Storm signals	228
Campbell island	425	Chandikho pahār	218
Campbell, Port	22, 314	Chandiko pahār	218
Anchorages, directions	314	Chandipur	229
Campbell reef, beacon	461	Chāndnipāl bar	226
Campbell rock, beacon	457	Chāndnipāl beacon	225
Campbell shoal	328	Chandpur	12, 252
Canister island	463	Storm signals	244
Canister island, Great	426	Chandragona	254
Canister island, Little	426	Chang, Kq	473
Canister islet, West	429	Channel creek	239
Canning, Port	13, 246	Channel islet	306
Anchorage	246	Chapel hill	142
Cap island	280	Chapel island	142
Cap rock	427, 432	Chapel point	142
Cap and Feathers rock	446	Chapel rock	142
Car Nicobar	347	Chardon pier, lights	150
Caution	348	Charka juru	332
Climatic table	82	Charles Ross hill	447
Eastern side	349	Charlotte island (Bentinck island)	447
Southern side	348	Charlotte island (Sisters island)	448
Tidal streams	350	Charlotte rock	449
Western side	348	Chatham island (Port Blair)	340

	Page		Page
Chatham island (Port Cornwallis)	322	Chokey point	379
Chauk	14, 391	Beacon	379
Chaukdaw rock	422	Tide gauge	382
Chauma gyun	413	Chokey shoal, buoys	379
Chaung, <i>see</i> proper name		Chokey track, lights	379
Chaungdalaung	288	Chong, <i>see</i> proper name	
Chaunggyi	297	Chota Nāgpur plateau	11
Chaungtha chaung	296	Chowra island	350
Chaungtha kyun	296	Anchorage, tidal streams	351
Chaungtha village	296	Christie island	470
Chaungwa village	397	Christmas island	437, 443
Chaves shoal	468	Christobal island	441
Cheding flats	457	Chula Lanka	121
Cheding rocks	458	Chundikkulam	159
Cheduba creek	284	Church rocks	296
Cheduba island	285	Chuttram	171
Aspect	285	Cinque islands, anchorage	343
South-western coast	285	Cinque rocks	312
off-lying dangers	285	Clappenburg bay	146
Tidal streams	286	Wharf	148
Cheduba strait	282	Clappenburg hill	143
Beacon, dangers in approach	283	Clappenburg island	143
Caution	282	Clappenburg point, beacon	143
Directions	284	Clappenburg spit	146
Inner part	284	Buoy	147
anchorage, dangers	284	Clara island	459
Light	283	Clarke point	137
Outer part	283	Cleugh passage	306
dangers	284	Dangers	306
Cheduba town	284	Tidal streams	307
Chelitivo islet	138	Cleugh rocks	306
Chen point	134	Climate and weather	43
Cheruga creek	271	Air temperature	65
Chester island	442	Climatic tables, humidity	68
Chevalier islet	429	Cloud, rain	62
Chevalier rock	429	Cyclones	48
Chicacole	9	Gales, nor'westers	57
Chidambaram pagodas	180	Pressure	43
Chiddle rock	130	Hail, thunderstorms	64
Chik, Pak	480	Visibility, waterspouts	64
Childers channel	287	Western depressions	57
Chilka lake	10, 217	Winds	44
Chilka mouth	217	Clump, North	198
Chimakurti	195	Clyde island	442
Chimney hill	134	Cocanāda bay	8, 202
Chimney island	469	Anchorage, signal station	203
Chimum taung	424	Aspect, dangers in approach	202
China bay	147	Climatic table	73
Lights, piers	148	Directions, tidal streams	204
China Bay wharf	149	Lights	202
China Bakir flats	373	Port facilities, storm signals	204
China Bakir light-vessel	372	Town	204
China Bakir river	17, 372	Cocanāda river	204
Chindwin river	385, 396	Cochin island	426
Climate, communications	398	Cockburn islands	467
Pilotage, rise and fall	398	Cockatoo point	369
Chingleput district	6	Cocks Comb rock	471
Chinsura	237	Coco channel	304
Chiriya tapu	318, 343	Caution	304
Chirume island	320	Currents, tidal streams	305
Chittagong division	13	Coco island, Great, anchorage	303
Chittagong hills	11	Coco island, Little	303
Chittagong, Port of	14, 254	Coco islands	21, 302
Climatic table	78	Tidal streams	304
Directions	257	Cocoanut point	295
Jetties, moorings, port facilities	258	Cod bay	148
Radio station, radio D.F. station	253	Cod point, buoy	148
Town	258	Colair lake	8
Chittivalasa	210	Colebrooke island	330

	Page		Page
Colebrooke passage	22, 330	Criddles island	444
Anchorage	330	Crocodile creek	363
Coleroon point	180	Cross harbour	355
Coleroon shoal	181	Cross point	329
Coleroon river	5, 180	Cross Sand channel, buoys	380
Collies island	459	Crown island	446
Colombo, Port of	92	Cuckold point	259
Aspect, currents	92	Cuddalore, Port of	6, 181
Climatic table	70	Anchorage, port facilities	182
Dangers in approach, buoyage	92	Entrance	181
Directions	93	bar	181
Harbour	93	lights, tidal signals	182
lights	93	Light, signal station	181
mooring berths	96	Storm signals, town	182
piers and jetties	95	Cupola rock	471
Harbour signals	97	Curlew island	325
Life-saving, port facilities	100	Currents	23
Pilots	94	Effect of tropical revolving storm	29
Quarantine, town	99	Off Ceylon	28
Radiobeacon, radio station	101	Strength of currents	27
Colpetty station	101	Summary of monthly currents	26
Colvin point	320	Cursetjee shoal	272
Combermere bay	276	Cuthbert bay	327
Anchorage, caution	276	Cuttack district	10
Command bay	340	Cuttack town	10, 227
Command point	339	Cutters patch	287
Communications	38	Cutters rock	289
Comorin, Cape	3	Cypress clump	265
Cone hill	343	Cypress point	265
Cone island	427	Cypress sands	265
Cone islet	449		
Connaught, Cape	359		
Conspicuous rock	275		
Constance bay	315	Da That island	412
Constance islet	317	Dacca division	12
Constitution bank	449	Dacca town	13
Consular officers, British	42	Dædalus rock	132
Contai	12	Dagmar river	22
Convict patch	325	Daisy rocks	427
Cooch Behar	11	Dak Anaing	22
Coombs pillar	256	Dak Kea	22
Cooper's Driver island	449	Dak Tayal	22
Cooum river	7, 186	Dakatia river	252
Coral bank	467	Dakhin Shāhbāzpur island	251
Coral point	139	Dakshina Dhāmra village	225
Corbin island	431, 440	Dakshindhāmra village	225
Cornwall point	435	Dala river	17
Cornwallis point	468	Dala suburb	377, 383
Cornwallis, Port	22, 321	Pagoda	383
Anchorage, climate	323	Dalet chaung	15
Dangers in approach	321	Dalhousie island	245
Directions	323	Dalhousie point (Bassein river)	366, 369
Islands and dangers	322	Dalhousie point (Kyaukpyu har-	
Coromandel coast	4, 176	bour)	280
Currents, general remarks	176	Dalhousie point (Matla river)	245
Courts island, anchorages	442	Dalla suburb	383
Covelong point	185	Dalrymple bank	346
Covelong village	185	Dalrymple, Cape	328
Cow and Calf islets	301	Dam, The Great	173
Coxon point	327	Damodar river	12
Cox's Bāzār	14, 262	Damatha taung	410
Storm signals	263	Dana, Pulau	459
Cox's bluff	262	Dandrāsi peak	215
Crab islet	431	Danot beacon	378
Cradle rocks	418	Dansborg fort	179
Craggy island	323	Danson bay, anchorage	296
Crane jetty	433	Danubyu town	384, 388
Crawford shoal	298	Daphne rock (Bentinck route)	446
Crawley, Point	337	Daphne rock (Little Coco island)	304

	Page		Page
D'Apres shoal	250	Dikwella village	124
Tidal streams	251	Diligent strait	330
Darebank river	18, 399	Directions, tidal streams	331
Darjeeling	11	Dindi house	196
Dark hill	283	Diomedea rock	157
Daughish island	440	Divi island	8
Daung, <i>see</i> proper name		Divi point, current	197
Daungnet taung	428, 432	Divi point, False	196
Davidson rock	134	Diya Mudawa	114
Davis island	469	Diyamba Lihini	115
Dawna range	18	Diyatalāwa	2
Dayā river	10, 218	Diyumba rocks	120
De Berry rocks	308	Diyumba Alut rock	120
Deadman's cove	143	Dockyard shoal, buoyage	151
Deba gala	106	Dodampara rocks	106
Debaha rock (Koggala lake)	118	Dodanduwa gala	108
Debaha rock (Telwatta point)	108	Dodanduwa point	108
Dedaye town	17, 387	Dodanduwa village	108
Defence island	314	Dolphin islands	461
Dehiwala station	101	Dolphin shoal	260
Delft channel, dangers	168	Dolphin's Nose (Heinzē chaung)	414
Delft island	167	Dolphin's Nose (Vizagapatam)	206
Anchorage, beacons, light	168	Domel island	447
Delgarno island	320	Dondra head	122
Delmar hill	107	Beacon, lights	123
Dematagala	128	Currents	122
Dennis rock	446	Donelly island	454
Deoben, Mount	22, 359	Donelly reef	453
Deodongar peak	9	Donkey's Ears, The	476
Deserter's creek	378	View	<i>facing</i> 480
Deumba gala	117	Doone point	333
Devi point	220	Dorava point	128
Devi river	10, 220	Dorava rock	128
Anchorages	221	Doris island	450
Devi river, Great	220	Doris rock	446
Devi river, Little	220	Dorothy island	449
Devil's Hole creek, lights	379	Dorrington, Point	336
Devil's Horn	400	Dottrel island	325
Devil's point (Ceylon)	168	Double island	401, 407
Devil's point (Exhibition harbour)	353	Caution	407
Devipattanam	5, 174	Light, tidal streams	407
Dhāmra river	10, 225	Double islet	479
Anchorage, directions	227	Double rock	444
Entrance channel, buoys	226	Dowlaisweram	8
Light	226	D'Oyley hill	307
Off-lying islands	225	Doyly hill	307
Pilotage	227	Dragon shoal	288
Dhanai peak	218	Drake island	469
Dhanushkodi	5, 171	Drakes island	444
Pier	171	Drunken Sailor rock (Colombo)	92
Diamond, Cape	336	Drunken Sailor rocks (Irrawaddy)	393
Diamond hill	143	Drunken Sailor rock (Sandoway)	291
Diamond harbour	239	Dring harbour	351
Anchorage	241	Anchorage	362
Signal station	239	Dry Tree point	378
Diamond island	365	D'Silva shoal, light-buoy	379
Anchorage, directions	366	Dufferin point	468
Climatic table	83	Dugarazupatnam village	192
Light	365	Dum Dum airport	243
Light-buoys, tidal streams	366	Dumpty island	441
Storm signals	367	Duncan island	337
Diamond point	143	Duncan passage	344
Diamond sand	237	Current, tidal streams	344
Diavolo, Mount	21, 327	Dundas point (Port Blair)	341
Dibrugarh	12	Dundas point (Port Cornwallis)	321
Dacey shoal, buoy	280	Dunkin island	470
Dickenson channel	278	Dutch bay	141
Digwah Mohan stream	231	Anchorage	144
Dikwella bay	124	Dutch point	141

	Page		Page
Duwe modera hill	105	Elizabeth island	145
Duwe modera lake	106	Elizabeth point	155
Dyke island	474	Elphinstone harbour	22, 327
		Anchorage	329
		Approaches	327
		buoys, dangers	328
		Directions	330
Eagle point	147	Elphinstone island	430, 440
Beacon, light-buoy	147	Elphinstone passage	316
East bay (Katchall island)	359	Elphinstone peak	430
East Bengal province	13	Eluvativu	166
Health	14	Empress peak	22, 359
Physical features	13	Engineer ridge	150
Ports	14	Ennur backwater	191
East channel (Palk strait)	164	Ennur shoal	191
East Harbour beacon (Rangoon)	380	Ennur village	190
East island (Landfall island)	306	Anchorage	191
East island (Ritchies archipelago)	333	Enounga village	357
East islet (Mergui archipelago)	442	Enterprise flat	369
East ledge (Heinzé group)	417	Enterprise island	369
East Pakistan	13	Entrance hill	336
East peak (Lampi island)	461	Entrance islet	430
East point (Dhāmra river)	226	Entry island	337
East point (Outram harbour)	331	Ereminia Gala point	117
East reef (Childers channel)	287	Etawa reef	124
East Spur islet	441	Ethiopia shoal	160
East Twin islet	319	Evans island	440
Easter point	356	Evelyn peak	468
Eastern channel (Galle harbour)	114	Excelsior island	320
Eastern channel (Hooghly river)	238	Expedition harbour	353
Buoys	239	Anchorage, directions	354
Eastern channel (Matla river)	245	Caution	353
Eastern Ghāts	8		
Eastern Grove flats	374	Fairlie rocks	157
Eastern Grove light, view	374	Fakir hill, pillar	252
Eastern sand	374	Fakir point	269
Eastern Sea reef	237	Signal station, tower	270
Eastern shoal	356	Fakir reef, light-buoy	270
Eden channel	238	Fakirmura hill	266
Edgecumbe point	354	False A peak	416
Edinburgh, Cape	360	False bay	224
Edmund island	453	False Divi point	196
Edward island	425	False Kettle bottom	191
Edwards pillar	111	False peak	430
Eedoo reach	245	False point	222
Egeria patch	133, 135	Caution, light	221
Currents	133	False Point anchorage	222
Egg island	325	Anchorage, directions	223
Eight-foot patch	164	Tidal streams and current	223
Ekveni gala	101	False Point Divi	196
Elbow point (Bassein river)	369	False rock	286
Elbow point (Takua Pa inlet)	481	Farquhar island	459
Elbow point (Tavoy river)	420	Fat hill	298
Elephant island (Bassein river)	369	Father island	449
Elephant island (Bentinck route)	445	Feather Tree, anchorage	481
Elephant island (Trincomalee)	142	Fell passage	438
Elephant pass	143	Depths	438
Elephant point (Cox's Bāzār ap- proach)	263	Directions, tidal streams	439
Elephant point (Rangoon river)	372	Islands and dangers, beacon	438
Elephant point (Trincomalee)	142	Fenny river	13
Elephant point (Vandeloos bay)	137	Fenton point	416
Elephant ridge	142	Finger peak	185
Elephant rock (Elephant point)	138	Fink island	456
Elephant rock (Patanagala point)	130	Firefighting jetty	149
Elephant rock (Point de Galle)	113	Firth rock	456
Elephant rock (Trincomalee)	143	Fish harbour	468
Elfin patch	324	Fish rock	447
Eliza island	448		
Eliza rock	448		

	Page		Page
Fish shoal	156	Gadilam river	6, 181
Fish Trap point	415	Gah, Kō	481
Fisher bay	426	Gahti kyauk	297
Fisherman rocks	145	Gal pare, buoy	114
Fishery harbour	94	Gala, <i>see</i> proper name	
Mole, light	94	Galathea bay	361, 364
Five-Fathom patch	325	Galathea river	22, 364
Five Islands, The	463	Galboda kanda	105
Flagstaff point	141	Galbokka point	101
Flat hill	424	Galbraith rock	427
Flat island (Bentinck approach)	441	Galgoda hill	107
Flat island (Middle Andaman island)	311	Galgodiyana	121
Flat Island spit	271	Galle, Point de	109
Flat islands	393	Light, signal station	112
Flat islet	448	Galle Face esplanade	100
Flat reef, beacons	289	Galle harbour	112
Flat rock (Ava point)	157	Anchorage	112, 115
Flat rock (Invisible bank)	347	Aspect	110
Flatt island	286	Channels	112
Fletcher island	442	buoys, dangers	113
Fletcher Hayes strait	277	Directions, piers	116
Florence point	315	Head of harbour	115
Fly islet	448	Health, port facilities	117
Fly rock	448	Life-saving	117
Ford bay, anchorage	303	Pilotage	112
Ford, Mount	21, 316, 319	Quarantine, town	116
Ford's peak	316, 319	Gallop sand	408
Foreland, The	461	Galū gala	110
Forfar rock	453	Galua	92
Forrest passage	459	Buoy	93
Tidal streams	460	Galwala	92
Forrest strait	460	Gamai river	11, 229
Anchorage, directions	465	Gan island	120
Northern entrance	460	Gandhamana temple	171
Northern part	460	Gandura bay	123
beacon, islands and dangers	461	Anchorage	124
Southern part	462	Gandura point	123
islands and dangers	463	Gandura village	123
Tidal streams	460	Ganga, <i>see</i> proper name	
Forrester rock	147	Ganga, Pulau	474
Fort, The (Colombo)	92, 100	Gangahar river	230
Fort bay	355	Ganges harbour, anchorage	361
Anchorage	357	Ganges river	11, 251
Fort Frederick	141	Gangra, tidal signals	240
Signal station	152	Ganjām district	9, 212
Fort William, Calcutta	243	Ganjām town	9, 217
Foul bay	311	Garamchari hill	261
Foul island	294	Garamchori hill	261
Foul point (Car Nicobar)	348	Garden reach	242
Foul point (Mayu river)	266	Garret island	436
Foul point (Trincomalee), light	140	Gaspar channel	239
Four Tree hill	254	Gates, The	288
Freak islet	429	Gattai, Pulau	474
Frederick, Fort	141	Gaudama hill	387
Frederick point	315	Gautami Godāvari river	8, 199
French pass	147	Gaw taung	291
French point	146	Genawana islet	107
French possessions	20	Genn island	431
Friar's Hood	135	Geonkhali	12
View	136	Georgetown	190
<i>facing</i>		Georgina point	280
Fuel	38	Gertrude island	459
Funnel mountain	478	Gerty island	459
Fusilier channel	334	Ghāts, Eastern	5
Fytche point	369	Ghāts, Western	5
		Ghorparay rock	411
		Gibb creek	319
		Gibbet island	111
		Gifford island	431
Gaban, Pulau	460		
Gabtola light-vessel	238		

	Page		Page
Giles bank, buoy	278	Grim island	441
Gin ganga	2, 109	Grommet rock, buoy	144
Gingee river	6	Grove point	374, 398
Gintota Palama	109	Grub island	316
Gladys island	427	Guásuba river	246
Glasshouse island	469	Gūdāli hill	192
Glohing, <i>see</i> proper name		Guide pier	95
Glosenberg	111	Lights	96
Goalunda	12, 244	Guitar island	328
Storm signals	244	Gull rocks	124
Goda gala (Beruwala point)	104	Gulnare cove	486
Goda gala (Dodanduwa point)	109	Gundlakamma river	196
Goda gala (Unawatuna point)	117	Gungasager rocks	287, 291
Goda Lihini gala	115	Gunners Quoin	138
Godagala point	105	Guntur district	7
Godāvari district	8	Gupta crossing	256
Godāvari point	201	Gupta island	256
Beacon	201	Gupta point	256
Light	202	Gurugudu point	128
Godāvari river	5, 205	Gwa bay	294
Godawaya point	126	Anchorage	295
Godawaye point	126	Gwa chaung	295
Goh, <i>see</i> proper name		Gwa kyun	295
Goh, Pak	480	Gwa village	295
Golund ma	333	Gwa town	16
Gommoliya rocks	115	Gwataung	291
Gona gala (Panaduré)	103	Gyaing river	18
Gona gala (Unawatuna point)	118		
Gongala	119		
Goodrich plains	419		
Goods pillar	252	H. Prinsep island	442
Goodwin light-vessel	400	Hainggyi chaung	368
Goodwin sands	402	Hainggyi kyun	367
Gopālpur	9, 215	Haldane island	450
Anchorage, caution	216	Haldi river	12
Currents	217	Half Moon reef	461
Light, storm signals	216	Half-tide rock	312
Winds	216	Half-way anchorage	402
Gostani river	210	Halliday island	245
Goyangyi kyun	296, 299	Hambantota point	123, 126
Anchorage	298	Hambantota, Port of	126
Graham island	470	Anchorage, light	127
Grand harbour	353	Current	126
Grant's island	441	Winds	127
Grappler sand	245	Hamidardia island	261
Gravel hill	147	Hamidardia village	261
Great Basses reef, light	130	Hammenhiel fort	167
Great Basses ridge	130	Hand hill	322
Great Bolo rock	120	Hand peak	322
Great Canister island	426	Handran gala	105
Great Coco island	303	Hangapru village	459
Great Dam, The	173	Hānsuā river	222
Great Nicobar island	360	Hanthawaddy district	17
Eastern side	363	Harachandi temple	218
Western side	362	Harchandi temple	218
off-lying dangers	362	Harden cove	147
View	362, facing	Harden point	147
Great Sober island	147	Buoy	148
Great Swinton islands	466	Hāriābhāṅgā river	3, 12, 246
Great Tenasserim river	437	Haringhātā river	12, 249
Great Tenasserim valley	19	Harishpurgarh river	221
Great Western Torres islands	442	Harriet, Mount	339
Anchorage	443	Harris island	431
Green island	400, 406	Harry head	473
Light	400	Hastings harbour	19, 468
Greenlaw island	441	Anchorage, tidal streams	469
Gregory group	462	Islets and dangers	468
Grey rocks	426	Hastings island	464
Griffiths island	444	Hastings sand, light-buoy	380

	Page		Page
Hastings track	380	Hlæm, <i>see</i> proper name	
Hatam Urita Kalle	144	Hlaing river	17, 377
Hatam Urita Kallú	144	Hlaingbwe river	18
Hätia island	251	Hmau-gon village	293
Hätia islands	251	Hmawun beacon	378
Hätia river	251	Hmawun Lumps, light-buoy	378
Hattras passage	442	Hmawwun chaung	378
Hattrass passage	442	Hngetpyaw kyun	411
Haungtharaw river	18	Hnget-taung kyun	297
Havelock island	333	Hnget-thaik kyun	417
Hay island	453	Hngetthaik kyun	418
Hayat, Pulau	462	Hngetthaik taung	455
Haycock island (Bentinck route)	441	Hoare island	412
Haycock island (Hastings harbour)	468	Hoau village	354
Haycock mountain	91	Hobday island	317
Haycock rock	470	Hodge point	269
Hayes island (Bentinck approach)	442	Hog point	348
Hayes island (Mergui approach)	431	Ho-Ho village	354
Hayward island	466	Hoin-iphoh bay	359
Hayward point	364	Anchorage, village	359
Headlam patch (Andaman islands)	328	Hole-in-the-wall	388
Headlam patch (Ye river)	410	Holly island	445
Heanzay basin	414	Homalin town	384, 396
Heath rock	453	Homfray strait	330
Heckford bank	467	Honor rock	470
Heckford patch	270	Hood point (Port Blair)	340
Heinzê Bok	418	Hood point (Port Cornwallis)	322
Heinzê chaung	414	Hood's tower	142
Anchorage, tidal streams	415	Hooghly point	239
Heinzê islands	417	Signal station	239
Helby hummock	283	Tidal signals	240
Hel-fer island	444	Hooghly river	12, 235
Helmet island	464	Approaches	231
Heming rocks	139	anchorage, currents	234
Hen and Chickens rocks	449	directions	234
Henry island	442	general instructions, light- vessel	232
Henry rocks	285	outlying banks	231
Henry Lawrence island	332	pilot vessel, pilotage	232
Henzada town	16, 384	signals	232
Herbert island	429	tidal streams	233
Hext rock	444	Bore, current	236
Heywood channel	287	Buoyage, tidal streams	236
Hickman shoal	306	Climatic table	76
High island (Chaungtha kyun)	296	Signal stations, storm signals	239
High island (Forrest strait)	460	Tidal streams	236
Anchorage	460	Hooper patch	315
High island (Myingyi kyun)	297	Hope island	200
High peak	294	Old lighthouse	201
High rock	466	Hope point	408
High Peaked island	447	Hope Town settlement	340
Highest peak	467	Hope Town wharf	340
Highest summit	283	Horace point	352
Hikkaduwa gala	108	Horsburg island	467
Hikkaduwa point	108	Horsburg islet	467
Hikkaduwa village	108	Horse Shoe rock	471
Hill island	286	Horse Shoe shoal, buoy	270
Himalayan ranges	3	Horseshoe island	464
Hin, <i>see</i> proper name		Horsford bay, anchorage	330
Hin Bai, Hlæm	482	Howard island	429
Hinán village, anchorage	352	Howe island	442
Hinám village	352	Howrah bridge, lights	242
Hindelnattu	118	Howrah suburb	243
Hiniduma kanda	91, 111	Hswathwa river	295
Hindustan bay	469	Hswathwa village	295
Hintha kyun	402	Htan daung	296
Hiræ rock	107	Hua Krung Hyai	482
Hiran point	247	Hua Krung Noi, Hlæm	482
Hirimbure kanda	111	Hua Krung Yai, Lem	482
Hiwäh village	351		

	Page		Page
Hudson bay	308	Iskapalli village, anchorage	194
Hugh Rose rock	301	Island breakwater (Colombo)	94
Hukitola	222	Lights	94
Hulftsdorp district	100	Isle of Man	351
Hump island, North-west	463	Itoë village	356
Hump island, South	464		
Hump island, South-east	463		
Hump islet	311		
Humpty island	441	Jack island	453
Hunter bay	276	Jackson creek	345
Hut bay	345	Jackson ledge	306
Huyong, Kq	484	Jaffna lagoon	169
		Jaffna port	169
		Light	169
		Life-saving, winds	170
		Jaffna peninsula	161, 169
Ibha rock	126	Jagannāth temple	218
Ichāpur	215	Jāipur	227
Idamelle	106	Ja-lebar	333
Ilantottunu river	139	Jalpaiguri	11
Iléya village	360	Jambu location	222
Iléyha village	360	Jambu river	223
Illukatiya point	131	James patch	468
View	131	Jāmira river	245
Ilsa river	252	Jamshedpur town	10
Imbu Ranne gala, buoys	114	Jane island	448
India, Republic of	4	Jane rock	448
Communications, currency	4	Janet islet	448
Government	4	Jatādhārmohan river	221
Weights and measures	4	Javadi hills	6
Indian point	355	Jefford point	246
Indian sub-continent	3	Beacon	248
Inglis island	333	Jefford shoal	461
Inglis shoals	334	Jenkins island	459
Ingrinchaing kyun	275	Jensen sand	231
Inner beacon, North (Ye river)	413	Jerry island	303
Inner beacon, South (Ye river)	413	Jessop hill	308
Inner Kadda rock	113	Jessore	249
Inner Katta, buoy	114	Jhikurkhāli obelisk	242
Inner route (Mergui district)	425	Jhuta bar	227
Inner spit (Cox's Bāzār)	262	Jigerkhali obelisk	242
Interview island	310	Joan island	450
Interview passage	311	John Lawrence island	332
Interview sound	310	Johnny island, anchorage	440
Investigator channel	467	Johns point	327
Tidal streams	467	Jolly Boys island	318
Investigator ledge	294	Jones point	324
Investigator passage	429	Jotdar river	221
Investigator patch	304	Juanita shoal	299
Investigator rock (Orissa coast)	215	Jub point	356
Investigator rock (Rutland island)	319	Jubilee channel	450
Invisible bank	347	Juldia hill	254
Inye lake	16	Tidal semaphore	255
Inywa village	395	Juldia signal station	255
Iranativu, North	169	Julian island	452
Iranativu, South	169	Juna bay, anchorage	450
Iron island	428	Junction reach	370
Iron passage, tidal streams	432	Jungis, Pulau	472
Irrawaddy division	14	Jungle island	322
Irrawaddy river	385, 384	Juvir Kanama river	8
Buoyage, general remarks	385		
Current, routes	387		
Depths, rise of river	386		
Pilots	385		
Irrawaddy river, Upper	394	Kabaneë rocks	393
Climate, communications	396	Kabare gala	115
Fogs, population	396	Kabosa island	428
Routes	394	Kabra islet	361
Water	396	Kachchaitivu	168
Irrawaddy rock	278	Kachcheri (Galle)	116

	Page		Page
Kachcheri bay	150	Kamorta island— <i>contd.</i>	
Beacons, light, pier	150	Off-lying shoal	351
Kachchtivu	168	Western side	352
Kada point	119	anchorages, tidal streams	353
Kada rock	120	Kamou Duen, Glohng	478
Kadaung chaung	391	Kamou Yei, Glohng	478
Kadda rock, Inner	113	Kamut, Goh	478
Kadda rock, Middle	113	Kamyit chaung	293
Kadda rock, Outer	113	Kan, Goh	473
Kadda rocks	113	Kanarak	220
Kaddaikadu	159	Kanaung village	388
Kadeawella point	138	Kanaungto creek	382
Kadul rock	125	Kanda, <i>see</i> proper name	
Kaduveyaru river	176	Kandalur hill	195
Kadwe rock	427	Kandaung promontory	414
Kæo Hyai, Kq	485	Kandaw island	459
Kæo Nqi, Kq	485	Kandivalassa	211
Light	486	Kandrapatia river	222
Kahandawa point	125	Kang Kao, Goh	479
Kahandawa rocks	125	Kani village	397
Kai kah rock	470	Kanika sand	225
Kai kan rock	470	Kankesanturai	162
Kaikawalagala point	105	Anchorage, lights	162
Kājal river	250	Kanmaw village, beacon	454
Kakana taung	408	Kansbans river	11
Kákana village	349	Kantaung promontory	414
Kakerativu, beacon	169	Kanthé Thuki reef, buoy	172
Kakoni rocks	113	Kantu rocks	424
Kala taung	462	Kanyin taung	297
Kaladan anchorage	403	Kanyingón village	372
Kaladan river	15, 269	Kanzagyi island	459
Kalagyun	432, 438	Kapang, Pulau	459
Kalamentiya point	123	Kapuruwana rock	120
Kalamentiya rock	125	Karachi	13
Kalcotta rocks	122	Karachi rock, beacon	462
Kalegauk island	371, 408	Karaitivu, light	163
Kaleindaung river	286	Karamas rock	120
Kalemyo town	397	Karaithuri bay, entrances	459
Kalewa town	397	Karathuri village	459
Kalibhanj Diān	226	Kari Malai Utu malai	143
Kalikoti	229	Karikal, Port of	20, 178
Kalingapatam	9, 212	Anchorage, bar signals	179
Anchorage, dangers	213	Current, light	179
Aspect, light	212	Port facilities, signal station	179
Port facilities, town	213	Karikal settlement	20
Storm signals	212	Karnaphuli river	13, 254
Kaliveli lagoon	184	Anchorage, caution	253
Kalkuda bay	138	Beacons, buoys	256
Kalladan anchorage	403	Depths, pilotage	255
Kalmunai point	168	Directions	257
Tower	169	Entrance, aspect	254
Kalpi roads, compass adjustment	241	Outer bar, buoyage	255
Kalrayan hills	6	Signal station, storm and tidal signals	255
Kálu ganga	2, 103	Tide gauges, tidal streams	257
Kálutara	102	Kasalang	13, 254
Kaluwatte gala	103	Kassom mountain	398
Kalwin point	424, 433	Katahella rock	122
Light, obelisk	433	Kataragama peak	127
Kam Hyai, Kq	479	Katchall island	358
Kam Nui, Kq	479	Anchorage	359
Kam Tok, Kq	479	Katha town	385, 395
Kama	389	Kathēmā kyun	421
Kama kyun	418	View	<i>facing</i> 417
Kamat, Pulau	459	Katherine island	450
Kamba Bandina gala	115	Kathu Vallimuni reef	174
Kambakan Durgam	191	Katkovalam	159
Kambakkan Drug	7, 191	Katta gala	114
Kamorta island	352	Katta, Inner, buoy	114
Eastern side, anchorage	354		

	Page		Page
Katta, Outer, buoy . . .	114	Kinnear's passage . . .	459
Kattali . . .	245	Kinserley point . . .	323
Katukurundu islet . . .	110, 118	Kirimechiodai malai . . .	138
Katyang island . . .	461	Kirinda village . . .	129
Kau ye kyun . . .	459	Kirinde rock . . .	129
Kaukhāli tower . . .	231	Kirindi knob . . .	129
Kaulak, Ao . . .	482	Kirindi oya . . .	2
Kaulvada hill . . .	211	Kirindi point . . .	128
Kaveripattanam village . . .	178	Anchorage . . .	129
Kaviti beacon . . .	215	Kirindi village . . .	129
Kaviti village . . .	215	Kisseraing island . . .	452
Kavulavada hill . . .	211	Kistna district . . .	7, 197
Kawadi duwa . . .	115	Kistna old lighthouse . . .	197
Kawdut chaung . . .	408	Kistna river . . .	5, 196
Kawsong village . . .	477	Kistnapatam . . .	193
Kayaing river . . .	290	Kistnapatam backwater . . .	7
Kayikawalagala point . . .	105	Kluai, Hlām . . .	479
Kayindaung . . .	432	Klu-e, Lem . . .	479
Kayo island . . .	453	Knap island . . .	442
Kayts . . .	167	Knot island . . .	280
Anchorage, directions . . .	167	Ko Hlak, Ao . . .	482
Kazidiya kyun . . .	268	Kq, <i>see</i> proper name . . .	
Keating point . . .	348	Kq, Khlōng Pak . . .	480
Kelani gala . . .	92	Koal-ta-pain . . .	364
Kelatha hills . . .	18	Koddai . . .	141
Kémios bay . . .	348	Koddiyar bay . . .	144
Anchorage, tidal streams . . .	349	Islets and dangers . . .	145
Kémios village . . .	348	Koddiyar river . . .	145
Kemmendine reach . . .	383	Koddiyar sand . . .	145
Kemmendine suburb . . .	383	Kodigeri bungalows . . .	164
Kennedy island . . .	452	Koggala lake . . .	118
Keo Noi, Goh . . .	485	Kohinur bank . . .	262
Keráwa village . . .	352	Koi-hóa village . . .	352
Keroela rock, buoy . . .	151	Koila ghāt . . .	230
Kerr point . . .	363	Kokkilai lake . . .	158
Kesbara gala . . .	115	Kokunge kyun . . .	410
Ketti Paramane . . .	115	Kola islet . . .	106
Kettle Bottom . . .	191	Kola point . . .	119
Kettle Bottom, False . . .	191	Kolakone fort . . .	390
Kevuliya . . .	140	Kollupitiya station . . .	101
Khai Hyai, Kq . . .	479	Kolonna point . . .	124
Khai Jai, Goh . . .	479	Komari ridge . . .	133
Khan, Kq, light . . .	473	Currents . . .	133
Khandalla bank . . .	136	Komari village . . .	135
Khang Khao, Kq . . .	479	Komariya ridge . . .	133
Khao, <i>see</i> proper name . . .		Komariya village . . .	135
Kharnāsi river . . .	223	Komwē island . . .	432
Kharsuā river . . .	10, 225	Konāda village, anchorage . . .	211
Khayegōn kyun . . .	369	Konārak village . . .	220
Khi Nok, Hin . . .	483	Kondul harbour, anchorage . . .	362
Khirsinga hill . . .	214	Kondul island . . .	361
Khlōng, <i>see</i> proper name . . .		Anchorage, caution . . .	362
Khogyun . . .	458	Kondūr village . . .	192
Khor, Kq . . .	481	Konduruhela . . .	135
Khulna . . .	244, 249	Kongala . . .	132
Storm signals . . .	244	Konijedu hill . . .	195
Khwang, Kq . . .	478	Konnager . . .	242
Kidderpore docks . . .	237, 242	Kopata shoal . . .	109
Storm signals . . .	239	Kopenheat village . . .	362
Kidisingi hill . . .	214	Korha rock . . .	129
Kilakari . . .	5	Korolamba point . . .	122
Kin village . . .	397	Koronge island . . .	296
Kinbun taung . . .	414	Kosgoda station . . .	106
King island . . .	428	Kosgoda village . . .	106
King George V docks, Calcutta . . .	242	Kota gala . . .	117
King's Bank sand . . .	380	Kotaha rock . . .	120
Light . . .	381	Kotāra anchorage . . .	337
Training wall . . .	380	Kotāra point . . .	337
King's beacon . . .	380	Kotavanni rock . . .	118

	Page		Page
Kottagoda point	124	Kyaukpyu harbour	276
Kottagoda village	124	Anchorage, currents	281
Kottaipattanam	175	Caution, dangers in approach	277
Kottapatam backwater	193	Directions, tidal streams	281
Kottapatam (Guntur)	194	Northern side	278
Anchorage, obelisk	195	buoys, islands and dangers	278
Kottapatam (Nellore)	193	Southern side	279
Kovilam point, light	163	buoyage, islands and dangers	280
Kowita beacon	215	Town	281
Koyob	21, 338	Kyaukpyu kyun	418
Kraburi town	477	Kyaukpyu range	291
Krishna shoal, light-vessel	371	Kyauktan creek	378
Kropit, Pulau	408	Kyauktanaung chaung	459
Krounangye	414	Kyauktwe	275
Kruen, Pak	480	Kyaungdaung-mawgyi	417
Krung Nork	482	Kyaungtha river	296
Kudarppu	159	Kyaungtha village	296
Kudumbegala	134	Kyd island	337
Kugyi, Pulau	462	Kyeinni taung island	459
Kujidaba pahār	217	Kyeintali	295
Kujidheppo pahār	217	Kyeintali chaung	293
Kulikhati	229	Kyetiki gyun	411
Kumar khāl	257	Kyetmata	431
Kumbukkan aru	127	Kyettaik kyun	411
Kumbukkan oya	127	Kyin Ngai, Pulau	459
Kumburahela	135	Kynakpyu kyun	418
Kumla patch	426	Kyu kyun	278
Kunchan kallū	138	Kyun, <i>see</i> proper name	
Kunchikumban aru	157	Kyun Pila	466
Kungyaung taung	295	Kyundaw island	395
Kunkalle ganga	125	Kyungyi	411
Kuntaung kyun	439	Anchorage	412
Kunywa	392	Kyunhla taung	426
Kupata	107	Kyunsin-yē	428
Kura, Pak	480	Kyuntalaung	288
Kurundu kanda	111	Kyunthaya	276
Kushbhadrā river	10, 220	Kywede river	268
Kutu konda	206	Kywegu river	272
Kutubdia island	260	Kywe-tho-nyima promontory	415
Anchorage, beacon	260	Kywide river	268
Light	260		
Kwan, Goh	478		
Kwangtung point (Gt. Nicobar is.)	364	Laba chaung	420
Kwangtung point (Stewart sound)	325	Labiaung, Pulau	462
Kwangtung strait	332	Labyrinth islands	317
Kwanhla pagoda	399	Currents	317
Kwāte-tu-kwagé	345	Lacams channel	244
Kwethongyima promontory	415	Lachi islands	439
Kyaikhalaing pagoda	408	Ladies ridge	280
Kyaikkami village	399	La-e-alē island	441
Kyaiklat town	17	La-e-atet island	441
Kyakaik maw	462	Láful anchorage, directions	363
Kyan-eik taung	417, 421	Laila Rook island	455
Kyangin village	389	Laire point	355
Kyanmi chaung	459	Lakera Baranga	22
Kyauk-bu-taung	418	Lakkatoung	417
Kyaukchet kyun	390	Lakhya river	252
Kyaukchet village	390	Laldia island, beacon	261
Kyaukhinhmaw	293	Lalla Rookh island	455
Kyauk-kalat	457	Lambert bay, anchorage	304
Kyaukkayan islands	427	Lamp island	470
Kyaukmē island	427	Lampi island	460
Kyaukmedaung island	459	Lan, Kō	479
Kyaukmyaung village	385, 395	Landabaums	217
Kyauknakaungdaung	436	Landfall island, dangers	308
Kyaukpandu	278	Landfall point	250
Kyauk-pôn-gyi	421	Landfall rocks	306
Kyaukpya river	433	Land's End	171
Kyaukpyu district	15, 282		

	Page		Page
Lāngulya river	9, 211	Long island (Mergui archipelago) .	427
Lansiya rock	128	Long island channel	402
Lanywa	14, 391	Long rock	312
Lápate village	349	Long sand (Bassein river)	369
Larn, Goh	479	Long sand (Maipura river)	224
Laski village, landing	352	Longstones reef	400
Latouche island	310	Lop Rap, Kō	473
Lattādiā island	261	Lopátē village	349
Laule taung	272, 275	Loughborough island	466
Launglon Bok group	417	Loughborough passage	466
Anchorages	418	Low Country	1
Lawrence island	457	Low islet (Port Cornwallis)	322
Laws island, light	279	Low islet (Ramree harbour)	289
Leda point	356	Beacon	289
Ledaung kyun	279	Lower Long sand	237
Leeboard ledge	344	Light-vessel	238
Leik kyun	298	Lowis hill	308
Leik-u-daung	455	Luce hill	416
Lelk-u-kyun	462	Lukia island	256
Lem, <i>see</i> proper name		Lump rock (Bentinck route)	444
Lemro river	15	Lump rock (Mergui approach)	442
Lemyethna town	367	Lungyi village	390
Lenya river	19, 457	Lunka rock	442
Lenya village	458	Lyall island	442
Leslie's Garden	454	Lys shoal	428
Letkat taung	417		
Letkokkōn village	373		
Letpanchibaw village	392	Ma rock	125
Lewin rock	132	Ma-aing islets	436
Lewis point	340	Macaulay point, beacon	481
Lichune island	298	Macbride island	467
Life-saving	36	McCarthy island	466
Liffey sand	379	McClelland island	444
Buoyage	380	McClement hill	447
Lihini gala	109	Machai hill	446
Lime Kilns pier	339	MacIan island	467
Linmalokyun	436	Mackay island	467
Anchorage	437	Mackenzie island (Bentinck ap- proach)	442
Lion island	441	Mackenzie island (S. Andrews group)	467
Lion rock	429	Mackey bank	310
Little Andaman island	345	Macleod island (Mergui archi- pelago)	440
Little Basses reef	131	Macleod island (S. Andrews group) .	467
Little Basses ridge	131	MacNab island	467
Little Bolo rock	120	Macpherson strait	22, 317
Little Canister island	426	Anchorage, directions	318
Little Coco island	303	Islands and dangers	318
Little Devi river	220	Tidal streams	318
Little Nicobar island	359	Mada gala (Dodanduwa)	108
North-eastern side	360	Mada gala (Galle approach)	110
anchorage	360	Madampe lake	107
Off-lying islets and dangers .	360	Madaya river	385
anchorage	360	Madda gala	104
South-eastern side	360	Madhya Pradesh state	9
Western side, anchorage	360	Madi gala	101
Little Powder island	150	Madras, Port of	186
Beacon	152	Anchorage, port limits	188
Little Quoin island	297	Aspect, light	186
Little Russell island	464	Climate, city, port facilities	190
Currents	464	Climatic table	72
Little Sober island	147	Cyclones, surf, storm signals	189
Little Tenasserim river	19, 437	Harbour	187
Little Torres islands	443	depths, lights, moorings	187
Lively rocks	156	Prohibited anchorage, quays	188
Livermore shoal	410	Radio station, time signal	190
Livock bay, anchorage	447	Regulations	187
Lloyds island	444	Signals	187
Lokarupswāmi temple	205		
Long island (Elphinstone harbour) .	327		
Long island (Heinzē Bok)	418		

	Page		Page
Madras state	4	Man point	355
General remarks	4	Manalkadu	159
Physical features, ports	5	Manatkadu	159
Production and industry	5	Manda gala	108
Trade and shipping	5	Mandagala	128, 134
Madu ganga	106	Mandaitivu	167
Madumora reef	122	Mandalay	384, 393
Maggona point	102	Mandapam	171
Maggona village	103	Mandapam North beacon	174
Magwe town	390	Mandrell reef	427
Magyi island	412	Mangrove bay	340
Magyi kyun	288	Mangrove cove, pier	148
Magyigyun	288	Mangrove island	312
Mah Puteh, Pulau	463	Mangrove point	321
Mahabalipur point, light	185	Mannar island	170
Mahabeleshwar	196	Lights, port	170
Mahadini	230	Town	170
Mahámodera lake	109	Manners strait	343
Mahanadi point	221	Manneru river	7
Mahānadi river	10, 222	Manuan gala	109
Delta	217	Manusurukota hill	217
Maharani peak	351	Maonderu river	207
Maharatara	106	Mappin hill	207
Mahaweli ganga	2, 145	Maragal kanda	135
Mahawelli bay, anchorage	124	Marble bay	143
Mahawelli point	124	Marble island	461
Mahawelli rock	124	Marble isles, The	455
Mahé	5	Marble patch	462
Mahendragiri peak	9	Marble point, beacon	143
Mahendragiri range	214	Marcus group	431
Mahratta rock	422	Marcus island	431
Maidan, The	243	Marescaux rocks	134
Main wharf (Mergui)	433	Maria island, anchorage	448
Light	434	Maria, Port	430
Mainbapara rock	107	Anchorage	431
Maingkaing village	398	Maria rock	448
Maingy island	431	Marian island	445
Maipara point	224	Marine pier	143
Maipara river	224	Marsack shoals	324
Maipura point	224	Marshall channel	303
Anchorage	225	Tidal streams	304
Maipura river	224	Marshall rock	471
Maishkāl bluff	261	Martaban, Gulf of	371, 398
Maishkāl channel	261	Anchorage	372
Entrance, buoy	262	Tidal streams	373, 399
Directions, anchorage	263	Martaban hills	18
Maishkāl island	260	Martaban town	18, 406
Mala village	357	Martin island	444
Malacca village	349	Martin rocks	368
Anchorage	350	Martini sands	269
Aspect	349	Mary rock	297
Malagoda kanda	118	Māsānutippa village, temple	200
Malai, <i>see</i> proper name		Masein village	397
Malai Porru Putta paar	157	Masulipatam canal	197
Mālanchā river	12, 246	Masulipatam, Port of	8, 197
Malattar channel	6	Anchorage, beacon	198
Malay cove	147	Buoy, directions	198
Jetty	148	Light, port facilities	198
Malay tapu	317	Storm signals, town	198
Malcolm island	457	Masy, Cape	337
Male village	395	Matai nāla	225
Mali Don	426	Mataita-ānla, anchorage	364
Mali Kaing	426	Matakāl	162
Malikhā river	365	Matamuhari river	13
Maliwun, Glohng	477	Matara bay, dangers	122
Maliwun hills	472	Matara town	122
Maliwun settlement	477	Matarbāri island	260
Man, Isle of	351	Mātla river	12, 245
Man chaung	385	Caution, channels	245

	Page		Page
Mätla river— <i>contd.</i>		Meroe islet	360
Tidal streams	245	Metcalfe island	429
Mattabari island	260	Mewstone island	444
Maubin town	388	Miang, Kō	484
Maud, Cape	351	Mibya kyun, light	420
Maukkadaw village	397	Middle Andaman island	310
Maungdaw	265	Middle bank (Andaman islands)	306
Anchorage	266	Middle bank (Ramree harbour)	289
Maungmagan bay	416	Middle bank (Rangoon river)	378
Maungmagan islands	417	Light-buoys	378
Anchorages	418	Middle banks (Palk strait)	164
Maungmagan passage	418	Middle Button island	330
Maw, <i>see</i> proper name		Middle channel (Palk strait)	165
Mawgaung-dōn	457	Middle ground (Bentinck sound)	409
Mawken passage	470	Middle ground (Cheduba strait)	284
Mawlaik village	397	Middle hill (Heinzē chaung)	416
Mawyen village	293	Middle island (Karnaphuli river)	254
Maw-yut point	465	Middle island (Mergui archipelago)	442
Maxwell island	450	Middle Kadda rock	113
May island	449	Middle Moscos islands	417
Mayagala	128	Middle passage (Mergui approach)	432
Mayan island	443	Middle point (Trincomalee)	148
May-gaumgaun	298	Beacon, buoy	148
Mayo bay	293	Middle reef (Expedition harbour)	354
Mayo, Mount	319	Middle reef (Port Cornwallis)	322
Mayo point	356	Middle rock (Mahawelli bay)	124
Mayu point	268	Middle rock (Little Coco island)	304
Mayu range	15, 264	Middle sands (Maikhāl channel)	262
Mayu river	15, 268	Middle shoal (Maikhāl channel)	262
Anchorages, caution	269	Middle strait (Andaman islands)	311
Directions, tidal streams	269	Middle Sister island	459
Entrance	268	Middle Terrible	278
bar	269	Midnapore district	11
dangers, depths	268	Migyaunggaung	297
Mayu spit	269	Migyaunggaung kyun	297
Mayurbhanj hills	230	Migyaungye village	390
Meadows, Port	22, 336	Mildred island	369
Anchorages, directions	337	Milestone rock	297
Off-lying danger	337	Mills passage	330
Medina patches	444	Mills patch	293
Mee Meti Yawa	112	Milne island	450
Meeyanne gala	115	Milo, Pulo	360
Megaunggan kyun	298	Minbu town	390
Meghna river	12, 251	Minbyin village	282
Bore, storm wave	251	Minden rock	144
Melville point	333	Minerva bay	322
Menchāl island	360	Minerva patch	334
Menik ganga	131	Mingaladon airport	384
Merghi islands	436	Mingan chaung	271
Mergui archipelago	19, 424	Overhead cable	271
Caution	425	Mingaug chaung	278, 289
Routes	424	Mingin village	397
Mergui district	19	Mingyi Sakan island	459
Mergui harbour	433	Minhla village	390
Anchorages, beacons	434	Minto bay, anchorage	343
Climatic table	86	Minto point	468
Dangers, lights	434	Mirissa point	119
Directions, port facilities	435	Mirissa village	119
Storm signals	436	Miroe islet	360
Tidal streams	434	Mitchell point	324
Town	435	Moda village	395
Mergui island	433	Módara Muduwa rock	104
Northern approach	425	Modere Payan rock	120
Southern approach	436	Mogaung river	385
Western approach	428	Molly island	456
Mergui islands	436	Mon chaung	385, 391
Mergui pagoda	433	Monapālem village	192
Merk bay	329	Money island	445, 453
Mermaid passage	429	Money point	292

	Page		Page
Money summit	292	Mud cove	148
Monghyr	12	Piers	149
Monicardu point	174	Mud point	240
Monkey point (Pulau Besin)	472	Mud volcanoes	43
Monkey point (Rangoon river)	380	Mudigandi eru, beacon	196
Tidal semaphore	381	Mullaattivu shoals	158
Monkey Point track	380	Mullaattivu village, light	158
Monro rocks	134	Munayai Paru	140
Montgomery island	314	Munder Mohan stream	231
Monywa village	396	Mupon anchorage	403
Moolkalle point	122	Mupon pagoda	405
Mora rock	120	Mupon reach	404
Moratuwa	102	Mupon reef	405
Morawaka kanda	91	Mupon suburb	403
Morbhanj hills	230	Murray island	470
Morgan islet	429	Murray point	360
Morland rock	324	Mús village, anchorage	349
Morrel point	355	Mushroom reef	321
Morrell point	355	Mushroom rock	299
Morellganj, anchorage	250	Mussel islet	432
Morrison bay	452	Mut, Kō	478
Eastern side	453	Mutapolli bank	195
islands and dangers	453	Muttiabruj	235
Head of bay	454	Mutugala point	129
beacon	454	Mutwal point	93
Western side	453	Mutwal quay	95
Southern approach	455	Mutwal suburb	100
anchorage, directions	455	Muñg, Goh	477
Moscós channel	418	Myanaung town	386
Moscós islands	417	Myang, Pulau	462
Anchorages	418	Myang Basa, Pulau	462
Moscós islands, Middle	417	Myang shoal	462
Moscós islands, North	417	Myangmya district	16
Moscós islands, South	417	Myathalun pagoda	390
Moshóit village, anchorage	354	Myaungmya district	16
Mosquito islet	447	Myaungmya town	16
Mouat, Port	22, 315	Myebon river	276
Caution, dangers	316	Myebon town	276
Directions	316	Myedaw	393
Moulmein harbour	403	Myengmoletkhat peak	19
Buoys	403, 405	Myengun kyun	270, 274
Caution, fogs	406	Mye-ni-kyun	438
Port facilities, jetties, town	405	Myethpyin kyun	277
Storm signals, winds	406	Myethpyu kyun	277
Moulmein river	18, 399	Myingyan town	393
Anchorages	402	Myingyi kyun	297
Approaches	400	Myinkwa-aw	417
anchorage	401	Myinmoletkat peak	19
dangers, light-vessel	400	Myinmu town	393
Aspect	399	Myitkyina village	385
Channels	402	Myitmaka river	377
buoys, caution	402	Myitnge river	394
Directions	401	Myitson	395
Entrance	402	Myittha river	397
signal station	400	Myogwin village, bridge	388
Light	400	Mysore plateau	6
Pilotage, beacon	400		
Tidal signals, tidal streams	403		
Tide gauges	403		
Mount Lavinia hotel	93	Naaf river	264
Mount Lavinia station	101	Nabulé Pankhun	416
Mouse island (Bentinck approach)	441	Nabutara	106
Mouse island (Bentinck route)	443	Náf peninsula	264
Mouse island (Tavoy island)	425	Náf river	15, 264
Mower's point, beacon	382	Nade Munai paar	144
Moyapur, tidal signals	240	Naditivu	145
Mu river	385	Naga taung	288
Muang, Kō	477	Nagabauk	393
Muang Takuapah	480	Nagari hills	7, 191

	Page		Page
Nagari nose	191	Negapatam shoal	176
Nagarkhāna hill	252	Negrais, Cape	298
Nagakona hill	252	Nehindi rock	126
Nagore, anchorage	177	Neill island	334
Nakatta rock	125	Neligalpara	107
Naked islet	463	Nellore district	7
Nakhaungbauk kyun	276	Nellore town	193
Nala, Pulau	462	Nepal rock	289
Nalaban island	218	Nerbudda island	287
Nalla gala	104	Nerbudda shoal	287
Naltigiri peak	10	New island (Hooghly river)	244
Namkhana, storm signals	244	New island (Moulmein river)	402
Namunakuli	2, 135	New shoal	294
Nan Mao river	395	Nga Yot bay	297
Nancowry harbour	355	Nga Yot taung	297
Anchorage, tidal streams	357	Ngalapwe creek	280
Directions	357	Nganabya creek	269
eastern entrance	358	Ngapi kyun	271
western entrance	357	Ngathaingyaung town	367, 388
Eastern part of harbour	357	Nga-Thók kyun	438
approaches	355	Ngawun river	388
beacon, entrance	356	Ngayok bay	297
Western part of harbour	356	Ngayokkaung chaung	298
beacon	356	Nga-yot bay	297
entrance	355	Nga-yot chaung	298
Nancowry island	355	Ngazun	393
Nancowry ledge	328	Nghet-thalk taung	418
buoy	329	Nicholson cove	149
Nankauri strait	334	Nicholson island	332
Nanpayok taung	419	Nicobar island, Great	360
Nantha kyun	16, 294	Nicobar island, Little	359
Anchorage, light	294	Nicobar islands	22, 347
Narasapur point, obelisk	199	Currents, tidal streams	347
Narayanganj	244, 250	Health	23
Storm signals	244	Physical features, ports	22
Narche Koudar	146	Production and industry	22
Narcondam island	346	Niger rock, buoy	146
Narsimhakonda pagoda	193	Nilagalahela hill	134
Nasapo kyun	276	Nilappanikkan malai	157
Nasik district	205	Nilaveli hill	156
Nat kyun	411	Nilaveli village	157
Native pier	151	Nilewelli bay, anchorage	124
Natmhaw, tidal semaphore	403	Nilewelli point	123
Natmhaw point, tide gauge	403	Nilgiri mountain	229
Natmyat kyauk	286	Nilkete rock	103
Natyadoung	419	Nilwala ganga	122
Naukle jetty	433	Nindan Godella	109
Light	434	Ninepin island	442
Naungdaw kyun	276	Ninepin island, South	442
Nauri	229	Ninepins island	463
Nauwi rocks	420	Ninepins rock	470
Naval point	354	Nishanbotu	194
Beacon	356	Nizampatam bay	195
Navy bay	340	Anchorage, beacons	196
Navy point	340	Nizampatam town	196
Nawagam kanda	101	N'maikha river	365
Naya Serai	237	Noakhali	244, 251
Nayinativu	166	Storm signals	244
Nearchus passage, directions	443	Nopu Taung Saba island	458
Nearchus rock	443	Norman's point	253, 259
Neatstongue island	418	Caution, light	253
Neduntivu shoal	168	North Andaman island	307
Needle rocks	458	North Arcot district	6
Negapatam	6, 176	North bay (Bentinck island)	446
Anchorage, buoy	177	Anchorage	446
Current, Directions	177	North bay (Port Blair)	339
Light, Signal station	177	North Brother island	344
Port facilities, town	178	North Brother rock	470
Storm signals	177		

	Page		Page
North Button island (Diligent strait)	328, 331	North-west Hump island	463
North Button island (Launglon Bok)	418	North-west islet (Bentinck route)	448
North Button island (Tavoy island)	425	Norway islet	140
North Cone islet	459	Norway point	140
North cove	148	Current.	146
Jetty	149	Norway sand	145
North clump (Masulipatam)	198	Novára bay, anchorage	351
North Delay shoal	267	Novo, Porto	6, 180
North Direction island	430	Anchorage, directions	181
North D'Silva point	379	Storm signals.	181
North Inner beacon (Ye river)	413	Nui, Kô	479
North island (Heinzê group)	417	Nulbunno island	218
North island (Hnget-taung)	297	Nulyasai village	220
North island (Launglon Bok)	418	Nun river	10
North island (Maungmagan group)	417	Nuroni cove	123
North island (Port Cornwallis)	323	Nurrae Banga Nassi	222
North ledge	416	Nuvalrevu	214
North Moscos islands	417	Nwalabo taung	420
North Paps	282	Nyaungbin kyun	288
North Park island	449	Nyaungbinchaung	288
North Passage island	328	Nyaungu	391
North Passage reef	321	Nyaw-byin-aw	417
North patch	416	Nyaw-byin point	417
North patches	260	Nyaw-byin village	417
North peak	414		
North Phipps island	464	Oagi chaung	413
North pier (Colombo)	95	Oates island	441
North Pinnacle rock	429	Observation island (Forrest strait)	462
North point (Andaman strait)	336	Observation island (Mergui archipelago)	442
North point (Dhāmra river)	227	O'Connor island	466
North point (Port Blair)	338	Octavia bay	355
North point (Sound island)	323	Oil Discharge jetty	95
North reef (Migyaunggaung)	297	Oldham rocks	308
North reef (Ross island)	322	Oleboda kanda	102
North Reef island, anchorage	310	Olive island	460
North rock (Goyangyi kyun)	298	Oliver island	324
North rocks (Amherst coast)	407	Olokh town	11
North rocks (Tavoy island)	426	On chaung	284
North Rocky island	469	Ona gala, light-buoy	92
North Saddle peak	307	One-Fathom patch	307
North sands (Heinzê chaung)	414	One-Fathom shoal	321
North Sentinel island	316	Ongyun	298
Anchorage	317	Oppāda bluffs	210
North Sentinel islet	459	Orava rock	108
North shoal, buoy	279	Orchid island	325
North Sister island	459	Orestes shoal	368
North spit (Mayu river)	268	Orissa coast	176, 205
North Tall Tree	265	Orissa state	9
North Terrible	278	Orlando cove	147
North Toni beacon	174	Anchorage	153
North Travers island	369	Orol kaicha	335
North Twin island (Mergui archipelago)	465	Orr's hill	150
North Twin island (Saingbain kieu)	298	Osmaston shoal	328
North Twins	264	Osprey rocks	287
Northbrook patch	355	Ostenburg point, light	149
North-east breakwater (Colombo), light	94	Ostenburg ridge	142
North-east Little Torres island	443	Ottivakkam hill	186
North-east point (Hainggyi kyun)	367	Oublié rock	430
North-east Port beacon (Pamban)	172	Outer beacon (Ye river)	413
North-east Quoin island	448	Outer island	411
Northern Circars coast	205	Outer Kadda rock	113
Norshes rocks	140	Outer Katta, buoy	114
North-west group (Hnget taung kyun)	297	Outer peak (Ramree island)	282
		Outer spit (Cox's Bazar)	262
		Outram harbour, anchorage	331
		Outram island	331

	Page		Page
Owen, Port	425	Paleru river	7, 195
Anchorage	425	Palk bay	166
Tidal streams	426	Depths	166
Oya, <i>see</i> proper name		Eastern side	168
Oyster island (Arakan coast), light	267	beacons, off-lying islands	169
Oyster island (Stewart sound) . .	324	North-eastern side	166
Oyster island (Tenasserim coast) .	417	beacon, islands and dangers	166
Oyster pagoda	433	light	167
Oyster reef (Arakan coast), buoy.	268	Southern side	170
Oyster reef (Ramree harbour) . .	289	Tidal streams and currents . .	165
Oyster rock (Cheduba island) . .	285	Western side	174
		beacons, light	174
		Palk strait	161
		Channels, dangers	164
		Depths	161
		Directions, tidal streams and	
		currents	165
		North-western shore, light	163
		Southern shore, lights . . .	161
Pabu, Kō	484	Pallaipara rock	104
Pachumba island	471	Pallavaram hill	186
Padaung island	293	Palli gala	105
Padaw-aw, anchorage	428	Palmer point	315
Pagan village	391	Palmyra point	162
Page islet	431	Palmyras point	225
Paget island	308	Palmyras shoals, tidal streams	225
Pagoda peak	284	Palok	437
Pagoda point (Amherst coast) . .	407	Palur bluff	217
Pagoda point (Bassein river) 290,	365	Pālūru bluff	217
Pagoda point (Domel island) . .	456	Pamban island, danger	171
Pagoda point (Maungmagan bay) .	416	Pamban pass	172
Pagoda point (Ye river)	410	Beacons, buoy	173
Pahala point	131	Currents, pilotage	173
Pahua	360	Tidal streams	173
Painaisa island	275	Pamban port	5, 172
Paine's reef	450	Anchorage, beacon	172
Paira rock	351	Light, storm signals	172
Pak, <i>see</i> proper name		Off-lying danger	172
Pak Phra, Chong	485	buoy	172
Pak Phra, Hlæm	485	Town	172
Pakannge village	392	Pamban viaduct	172
Pakchan river	19, 471	Pambuthai Malai range	135
Caution, directions	475	Pambuttivu	147
Channels, anchorages	474	Pānadure	102
Entrance	475	Pānadure ganga	102
anchorage, light	475	Panawa ridge	134
Northern approach	472	Pānchpāra river	11, 230
beacons, dangers	472	Pandaw rocks	288
Settlement, winds	477	Pandi Aricha Munai paar . . .	146
River above Victoria point	477	Light-buoy	146
directions	477	Panditivo point	139
Southern and western ap-		Panglaing river	17
proaches	473	Panhlaing creek	377, 386
islands and dangers, light	473	Panmawadi flat	367
Tidal streams	475	Panmawadi river	16
Pakchan town	19	Pantaw rocks	288
Pakistan	13	Pantha village	396
Currency, general remarks . .	13	Panyam, Pulau	459
Government, weights and		Pao, Pulau	477
measures	13	Paps, The	466
Pakistan, East, <i>see</i> East Bengal		Paraiduwa	105
Pakokku town	384, 392	Paranga juru	334
Pala gala, buoy	92	Paravanār river	6, 181
Palan chaung	427	Parei duwa	120
Palangutaung	285	Pares shoal	119
Palanyon	391	Pariah rock, buoy	369
Palapana gala	120	Parititivu	166
Pālār beacon	184	Parker island	445, 453
Pālār river	7, 184	Parkprah, Chong	485
Palativu, tower	169		
Palatupana point	129		
Palauk chaung	426		
Palein peak	410		
Patenga taung	285		

	Page		Page
Parsons island	467	Peel point	245
Parsons point	362	Peepers, The	408
Parsons rock	467	Pegu division	14
Pascoe shoal	411	Pegu point	380
Anchorage	412	Pegu river	17, 377, 384
Pasipattanan mosque	174	Pegu town	384
Passage island	343	Pegu Yoma range	17, 384
Passage island, North	328	Peinnechaung kyun	275
Passage island, South	446	Pelagas kanda	105
Passage island, West	446	Penner river	7, 193
Passage rock (Akyab)	270	Anchorage	194
Passage rock (Cleugh passage)	306	Pentacota	204
Passenger jetty, lights	96	Perantala Kanama river	8
Passi rock	108	Perforated rock	447
Pa-sut-kyun	418	Perka village	349
Pat rock	469	Perlin, Pulau	472
Pata Polavarem, beacon	206	Perlis state	20
Patakund river	221	Persain, Cape	336
Patalamalai	144	Perseus point	315
Patana, The	2	Perseus reef	353
Patanagala point	130	Perseverance point (Port Blair)	339
Pataravakam hill	185	Buoy	339
Pataw island	433	Perseverance point (Port Corn-	
Patch, The (Port Meadows)	337	wallis)	322
Patch, The (Salween river)	400	Perumbakkam hill	186
Patenga point	253	Pesalai	170
Caution, light	253	Peter, Mount	280
Patent slip jetty, light	96	Peter Scott island	440
Patiagala point	107	Peterson rock	446
Patirajja point	128	Petrie island	314
Patna	12	Pettah, The	99
Patolon chaung	397	Pe-wet-seik kyun	369
Paton's island	440	Phaeton shoals	365
Patrick's gut, buoy	265	Phalein peak	410
Pattaravakkam hill	185	Phaungkala taung	408
Patten rock	134	Phayam, Kō	473
Patuakhali	250	Phi, Kō	475
Paungbyin village	398	Anchorage, light	475
Paungchon taung	416	Phoenix bay	340
Paunglaung river	399	Phoenix point	340
Paungnetkyi, light	279	Phō Ta Chong Dong, Khao	478
Pavanga shoal	247	Phra Chao, Hlām	485
Paw kyun	271	Phra Thong, Kō	480
Pawdi taung	414	Phrami, Khao	478
Pawē kyun	456	Phuket, Kō	20, 485
Pawkywn Thi	268	Phuket district	20
Payan, Hin	484	Phuket town	20
Payan, Kō	484	Pia Sima	478
Payang, Kō	484	Piam, Goh	473
Payi kyun	438	Pianam, Kō	478
Payway gorge	396	Pichaboui khāl	231
Pazin kyun (Tavoy river)	421	Pickwick group	445
Pazin kyun (Tenasserim coast)	417	Pickwick island	444
Pazundaung creek	380	Pidurutalagala	1, 91
Pazundaung suburb	383	Pig island	411
Peak island	447	Pigeon island (Ava point)	157
Peaked rocks	270	Pigeon island (Domel island)	447
Peehee point	303	Pigeon island (Point de Galle)	113
Peck shoals	318	Pigeon island (Great Nicobar island)	363
Pedro channel	160	Pigeon island (Weligama bay)	120
Anchorage, prohibited anchorage	160	Pigeon islet	206
Directions	160	Pila, Kyun	466
Pedro Channel Middle beacon	159	Pilai, Kō	485
Pedro Channel South obelisk	159	Pillam island	455
Pedro, Point, light	159	Pillar rock (The Buffaloes)	299
Pedro shoal, Point	159	Pillar rock (Pūdimadaka)	206
Pedrotalagala	91	Anchorage	206
Pedruana gala	109	Pillinawa point	131
Peel island	332	View	facing 131

	Page		Page
Pilot beacon, The (Amherst)	401	Powder rocks	151
Light	401	Beacon, light-buoys	152
Pilot reef	333	Pra Malai	141, 144
Pilot's ridge	224, 231	Pra Tang, Goh	480
Pimple hill (Mayu river)	269	Prāchi river	220
Pimple hill (Ramree island)	282	Preparis island	21, 300
Pin chaung	391	Anchorages	301
Pin island	449	Islets and dangers	301
Pinbwa island	437	Preparis North channel	300
Pindan kyun	436	Currents, tidal streams	300
Pindin village	397	Preparis South channel	302
Pine Tree island, anchorage	463	Caution, light	302
Pingwe, Pulau	474	Prewang, Pulau	463
Pinnacle point	354	Price, Cape	307, 319
Pinnacle rock (Ava point)	157	Prince's inlet	333
Pinnacle rock (Tavoy island)	426	Prinsep island	442
Pinnacle rock (Trincomalee)	152	Prinz Heinrich patch	121
Light-buoy	152	Clearing mark	121
Pinnacle Rock hill	156	Prome town	377, 387
Pinwun maw	462	Prompt rock	104
Pippli sand	231	Prompt shoal	120
Piria konda	215	Pudi, Point	192
Pirie island	453	Pūdimadaka village	206
Pitawatan point	127	Puggett's wharf, buoy	151
Pitt island	455	Puhumodal rock	120
Pittaniya rock	104	Puket, Goh	485
Plantain island	428	Puklaji	421
Plantain point	150	Pulau, <i>see</i> proper name	
Beacon, buoy	150	Puliantivu	166
Plowden island	222	Pulicat hills	7
Pluto island	317	Pulicat lake	7, 191
Po gala	103	Pulicat town	191
Póahat village, anchorage	352	Anchorage, light	191
Pocock island (Andaman islands)	320	Shoals	191
Pocock island (Forrest strait)	463	current	192
Point island	308	Puligadda arm	8
Pokalapet beacon	212	Pulinjerikuppam village	192
Polatu ganga	119	Beacon	192
Polkote gala, buoy	113	Pullai Kulam aru	155
Pollock reef	466	Pulivantivu	166
Pollok bay	303	Pulo Milo	360
Pondicherry	182	Puna Kuda point	138
Pondichéry, Port of	182	Punkudutivu	166
Anchorage	183	Light	167
danger area	183	Puravadalyanār river	178
Lights, quarantine	183	Puri, Port of	10, 218
Port facilities, winds	184	Anchorage, port facilities	219
Regulations, signals	183	Climatic table	75
Signal stations	183	Light	218
Town	21, 184	Storm signals, town, winds	219
Pondichéry settlement	20	Puri district	10
Production and industry	21	Purian bank	368
Pool, The (Mergui harbour)	434	Purian point	367, 371
Popa mountain	392	Pussur point	250
Poraiyār	179	Pussur light-vessel, radiobeacon	247
Port, <i>see</i> proper name		Pussur river	12, 246
Portland point	408	Bar, buoyage	247
Portman bay	343	Caution, directions	249
Portman, Cape	328	Pilotage, tide gauges	248
Porto Novo, <i>see</i> Novo, Porto		Putney island	246
Position rock	415	Putni island	246
Potter island	463	Pyamalaw river	16, 365
Pousar, Hin	484	Pyapon district	17, 371
Powder bay	150	Pyapon river	17, 365
Boat passage	152	Pygmalion point	362
buoyage	152	View	<i>facing</i> 362
Powder island	150	Pyin kyun	293
Powder island, Little	150	Pyinbyu chaung	420
Beacon	152	Pyindaye	17

	Page		Page
Pym-gyi, light	421	Ramree river	289
Pyinnigyun island	437	Ramsey islet	429
Pyinzalu river	16	Randambe lake	106
Pym island	442	Rangamati	13
Pymbong beacon	371	Ranger flat, buoys	341
Pyramid bay, anchorage	286	Ranger reef	306
Pyramid rock	286	Rangoon, Port of	381
Pyu kyun	277	Anchorage, prohibited anchor- age	381
		Beacon, obstruction	382
Quarantine regulations	40	City, port facilities, port limits	383
Quoin hill (Nâi peninsula)	264	Climatic table	84
Quoin hill (Sandoway)	294	Deratisation, storm signals	384
Quoin hill, Small	138	Trade and shipping, wharves	383
Quoin island (Heinzé group)	418	Rangoon river	376
Quoin island (Loughborough passage)	466	Beacons, buoyage	378
Quoin island (Mergui archipelago)	442	Dangers, lights	378
Quoin island, Little	297	Signals, tidal signals	381
Quoin island, North-east	448	Tidal streams and tides	377
Quoin island, South	449	Rangoon river approaches	372
Quoin rock	454	Current, tidal streams	373
		Entrance	374
		bar, depths, buoyage	375
		channels, light	374
		directions, tidal streams	376
		Pilotage, pilots	373
Ra, Kq	480	Ra-nohng creek	473
Rabnabad channel	250	Ra-nohng province	477
Rabnabad islands	250	Ra-nohng town	477
Rabnabad river	12	Ransom reach	369
Racha Hyai, Kq	486	Ranson shoal	461
View	<i>facing</i> 481	Rasamunai point	118
Racha Nqi, Kq	486	Rassamunai point	118
View	<i>facing</i> 481	Rasulpur river	12, 231
Raegara range	215	Rat island (Coco group)	303
Rah, Goh	480	Rat island (Mergui archipelago)	441
Raichafé village	351	Rat island (Tavoy island)	425
Railway cove	147	Ratapane rock	120
Buoy	148	Ratgama lake	108
Piers	149	Rathedaung creek	268
Raimangal river	12, 246	Rathedaung town	266
Raimatla channel	245	Rati beacon	214
Raimatla sand	245	Rattan point	126
Raja Noi, Goh	486	Ratti beacon	214
Raja Yai, Goh	486	Ravenshaw island	449
Rajabagan, tidal signals	240	Ray hill	326
Rajmahal hills	11	Ray point	357
Rajshahi division	12	Red bluff	155
Ramachandrapur	211	Red Crab island	261
Beacon	211	Red Skin island	316
Ramayapatam	194	Reddie point	222
Rambha village	218	Reef inlet	309
Rambilli village, beacon	206	Reef island (Morrison bay)	453
Ramchand temple	220	Reef island (North Andaman island)	308
Ramchaudi temple	220	Reef island, North, anchorage	310
Ramen point	171	Reef island, South	310
Râmeswaram temple	171	Reef islet	418
Ramnad district	5, 171	Reef light-vessel	237
Ramree harbour	286	Buoy, fog signal	238
Anchorage, dangers, beacons	289	Reef point	354
Approaches	286	Regu shoal	263
islands and dangers	286	Regulations	40
tidal streams	288	Reid point	355
Caution, directions	290	Reju shoal	263
Entrance	288	Rekawa point	125
beacon, islands and dangers	288	Reliance shoal, light-buoy	280
Tidal streams, town	290	Remarkable rock	293
Ramree island	280, 286	Remiah, Pulau	472
Western coast	282		

	Page		Page
Sale village	391	Satlaik kyun	421
Salihundam ridge	212	View	<i>facing</i> 417
Salin village	391	Satthwa chaung	295
Salome island	369	Satthwa village	295
Salt Colas	257	Satyogya chaung	271
Salu chaung	293	Saucer island	402
Salween district	18	Saugor island	239
Salween river	18, 399	Saugor roads	239
Anchorage	402	Saul island	466
Approaches	399	Saunders shoal, light-buoy	271
anchorage	401	Saung Kharang, Pulau	474
dangers, light-vessel	400	Saunggyi kyun	436
Aspect	399	Saurim island	429
Channels	402	Saurin island	429
buoys, caution	402	Savage island, light	270
Directions	401	Sawai, Hin	479
Entrance, dangers	402	Sáwi bay	348
Pilotage, signal station	400	Anchorage, beacon	348
Tidal semaphores, tidal streams	403	Tidal stream	348
Tide gauges	403	Sawi village	348
Sambore bay	145	Schwarte fort	114
Sambore river	145	Sealark rock (Galle harbour)	113
Sambore shoal	145	Buoy	113
Sameikkon village	392	Sealark rock (Weligama bay)	119
Sand cay	368	Searle point	282
Sandar ghât	256	Seaward peak	473, 478
Sanders island	470	Second Observation islet	447
Sanderson hill	447	Secundra rock, buoy	113
Sandheads, The	232	Seikgyi training wall	382
Anchorage	234	Beacon, light	382
Pilot vessel	232	Seiktha	389
Tidal streams	233	Seinnat taung	424
Sandoway district	15, 292	Sellore island	437
Sandoway bay, jetty	293	Semiramis bay	339
Sandoway river	16, 291	Sentinel island, North	316
Directions	291	Sentinel island, South	344
Sandoway town	16, 291	Sentinel islet, North	459
Sandwip channel	251	Sentinel islet, South	459
Sandwip island	250	Seppinas peak	276
Sandwip village	251	Seppings peak	276
Sandy island	296	Sergeant island	442
Sandy point (Cheduba island)	283	Sesostriis bay, lights	339
Sandy point (Little Andaman island)	345	Sesostriis rocks	369
Sandy point (Kalingapatam)	211	Sesostriis shoal	339
Sánenya village	350	Set, Pulau	466
Sangama kanda	135	Setse Yele Paya islet	402, 407
Sangama Kanda point	133	Shagstone	441
Light	135	Shāhbāzpur river	250
Sangu river	13, 259	Shāhpuri flat	264
Sanjib peak	206	Shāhpuri point	264
Santapilli rocks	212	Shāhpuridwip	264
Clearing mark	212	Shallinger shoal	193
Light	211	Shan hills	395
View	<i>facing</i> 212	Shark island	310
Saptamukhi channel	244	Sharp hill	136
Saptamukhi river	244	Shaullavanaigenpatam	164
Saptamukhi sand	244	Shearme island	308
Sar lake	10	Shearme sand	410
Sarameti mountain	398	Sheila rock	469
Sargent island	442	Shell bay	141
Sarwar sand	247	Shevaroy hills	6
Satara reef	213	Shinmaw-daung	419
Satbaia sandhill	223	Ship rock (Great Basses)	130
Satbhaya sandhill	223	Ship rock (Kadeawella point)	139
Satellite bay	355	Shitpyin kyun	461
Satellite ledge	294	Shittaunggyi	424
Satellite patch	357	Shoal bay	337
Satellite point	353	Shoal Bay creek	337
		Shong Pianam	478

	Page		Page
Shong Pianam— <i>contd.</i>		Sir Robert Campbell island . . .	459
Anchorage	478	Sir William Peel island . . .	332
Directions	479	Sirajganj	12
Shore point	340	Sirrocca rock, buoy . . .	405
Shortt island	224	Sister island, Middle . . .	459
Light	226	Sister island, North . . .	459
Shoulder point	157	Sister island, South . . .	459
Shrub rocks	436	Sister shoal, buoy . . .	147
Shwedagon pagoda	383	Sisters islands (Bentinck route) . . .	448
Shwedaung	389	Sisters rocks (Aladdin islands) . . .	470
Shwēgu village	385, 395	Sisters, The (Andaman islands) . . .	344
Shwekyauung chaung	392	Sitākund mountain	252
Shwelaung	16	Sitaparokia hill	266
Shweli river	385, 395	Sitaparokia patches	267
Shwemoktaw pagoda	370	Sitkyun village	388
Shwetaung kyun	402	Sittang river	18, 371, 399
Shwetaung	420	Bore	399
Shweudaung village	395	Sittang village	18
Shweyin-e taung	423	Sittaung	398
Shwezaye gorge	396	Sivasamudram	6
Sidaw point	413	Skinner island	466
Sidaw taung	410	Slave island (Aladdin islands) . . .	469
View	<i>facing</i> 416	Slave island (Colombo)	100
Siddi island	252	Sleet rock	122
Sidney island	454	Slipper island	302
Sieve hill	416	Sloop rock	471
Signals	30	Small Quoin hill	138
Similan islands	484	Small Sober island	147
View	<i>facing</i> 481	Smart island	429
Similan, Kō	484	Smith, Cape	327
Simpson point	323	Smith island	321
Simpson shoal	411	Smooth islet	145
Sims reef, beacon	472	Smyth rock	336
Sin taung	407	Snark island	310
Sinbaikchaing	278	Snob island	317
Sinbaungwe village	390	Snug cove	146
Sinbyubyin village	19, 422	Sober island, Great	147
Anchorage	422	Sober island, Little	147
Sinbyugyun village	391	Sola creek	231
Sinclair bay, anchorage	450	Sombbrero	350
Sinclair shoal	410	Sombbrero channel	359
Sindarar, Kō, anchorage	471	Dangers, tidal streams	359
Sindarar Nua, Kō	471	Sombbrero island	360
Sindarar Tai, Kō	471	Sombbrero point	359
Singarayakonda temple	195	Son island	449
Singarazu peak	9	Sonādia island	261
Singaung kyun	290	Sonapur	215
Singaung reef	291	Sonma kyun	413
Singaung taung	425	Sonnāpurampeta	215
Singaling hkamti village	396	Sound island	323
Single rock	444	Sound peak	310, 325
Singu village	391	South Andaman island	314
Singyat kyun	291	South Arcot district	5, 181
Sinha's beacon	379	South bank (Andaman islands) . . .	306
Sinkan village	395	South banks (Palk strait)	164
Sinma chaung	297	South bay (Great Nicobar island) . . .	361, 364
Sinma kyungyi	297	Anchorage	364
Sinma village	297	South bay (Katchall island)	359
Sinnatayu	169	South bay (S. Matthew's island) . . .	468
Sinswe kyun	369	Anchorage	468
Sipsa point	247	South beacon (Rangoon river)	378
Beacon	248	South Broni river	222
Sipsa river	247	South Brother island (Duncan	
Sipsah point	247	passage)	344
Sir Charles Metcalfe island	429, 441	South Brother rock (Aladdin	
Sir E. Owen island	450	islands)	470
Sir Hugh Rose island	334	South Button island (Diligent	
Sir J. Malcolm island	450	strait)	331
Sir John Hayes island	442		

	Page		Page
South Button island (Moscos islands)	418	Spence sand	231
South Button island (Tavoy island)	426	Spike hill	298
South Cinque island	343	Spike island	311
South cliff	263	Spit channel, light-float	375
South Cone islet	459	Spit sand	373
South Delay shoal	267	Spiteful bay	355
South Direction island	430	Anchorage	357
South hill (Tavoy approaches)	424	Split rock	134
South hummock (Nyengun kyun)	275	Spur islet, East	441
South Hump island	464	Spur islet, West	441
South Inner beacon (Ye river)	413	Spur rock	471
South island Hgnet taung	297	Squadron rocks	278
South island (Launglon Bok group)	417	Square rock (Aladdin islands)	471
South island (Maungmagan group)	418	Square rock (Morrison bay)	454
South island (Port Cornwallis)	323	Square rock (Peinnechaung kyun)	275
South island (Tavoy island)	425	Square rock (Sound island)	324
South ledge (Launglon Bok group)	418	Sriharikota island	192
South Moscos islands	417	Stag island	410
South Ninepin island	442	View	<i>facing</i> 416
South Park island	449	Stainer rock	473
South Passage island	446	Standard time	37
South Passage reef	321	Star island	453
South patch (Coco group)	304	Steep point	312
South patches (Chittagong approaches)	261	Steep shoal	462
Buoy	262	Stewart island (Mergui archipelago)	466
Light-vessel	261	Stewart island (Stewart sound)	324
South peak (S. Matthew's island)	468	Stewart sound	22, 323
South Phipps island	464	Anchorage	324, 326
South Pinnacle rock	429	Directions, tidal streams	326
South point (Andaman strait)	336	Northern entrance	324
South point (Dhāmra river)	227	Settlement	326
South point (Great Nicobar island)	363	Southern entrance, buoy	325
South point (Outram island)	333	Stoat island	312
South point (Port Blair)	338, 342	Stodart rock	445
South point (Port Cornwallis)	323	Stony point, beacon	369
South Quoin island	449	Stork islet	471
South reef (Migyaunggaung)	297	Stork shoal	160
South reef (Port Cornwallis)	322	Stowe point	333
South Reef island	310	Strachan, Cape	327
South rock (Borong point)	275	Strait island	329
South rock (The Buffaloes)	299	Street island	442
South rock (Kō Kham group)	479	Stuart, Point	309
South rock (South Terrible)	278	Subarnarekha port	231
South rock (Taung kyun)	286	Subarnarekha river	11, 230
South rocks (Peinnechaung kyun)	275	Anchorage	231
South rocks (Tavoy island)	425	Submarine cables	38
South sands	415	Sudi konda	205
South Sentinel island	344	Sugarloaf hill	210
Anchorage	345	Sugarloaf island	309
South Sentinel islet	459	Sulaiman range	3
South Sharp peak	295	Sun temple, The	220
South shoal (Bentinck sound)	408	Sunai river	230
South Sister island	459	Sundarbans, The	12, 244
South spit (Mayu river)	269	Sunk reef	324
South Terrible	278	Sunta creek	222
South Travers island	369	Sureya Tree bay	124
South Twin island	465	Surveyor rock	136
South-east head (Trincomalee)	147	Swallow island	470
South-east Hump islet	463	Swarnamukhi river	7, 193
South-east point (Hainggyi kyun)	367	Swatch of No Ground	246
South-west breakwater (Colombo)	93	Sweat bay	143
Light	93	Swell rock	126
South-west tail (Rangoon river)	374	Swinton islands, Great	466
Southampton hill	147	Swirl rock	440
Southampton road, anchorage	281	Sydney island	455
		Sylhet district	13
		Sylvia island	441
		Syriam point	380

	Page		Page
Table bay, anchorage	302	Tatagy island	436
Table island	302	Talangē island	439
Anchorage, light	302	Taukopah inlet	480
Climatic table	80	Taung, <i>see</i> proper name	
Table islands (N. Andaman island)	320	Taung kyun	286
Table reef	321	Taungbyauk chaung	420
Tadikelly hill	307	Taungdwin village	397
Tadma bay, directions	334	Taunggwin village	390
Tadma juru, directions	333	Taunggyan taung	298
Tāe-angha village	362	Taunglun taung	294
Tagaung village	385, 395	Taungmagyi taung	292
Tagaungde rocks	392	Taungni taung	284
Taik kyun	284	Taungnyo hill	264
Taikaing village	370	Taungnyo range	18
Taikthonlon	297	Taungthonion	432
Tajam, Pulau	466	Taungthonlon	432
Takla Oyster point, buoy	325	Taungup chaung	290
Takua Pa, light	480	Taungup village	290
Takua Pa inlet	480	Taungyo taung	264
Anchorage, beacon	481	Tavoy district	18, 423
Caution	480	Tavoy island	425
Directions, tidal streams	481	Tavoy point	417
Entrances, light	480	Tavoy river	18, 419
Takua Pa town	481	Anchorage, directions	422
Talaiady	159	Aspect	419
Talaimannar	170	Estuary	420
Lights, pier	170	islands and dangers, lights	420
Talakaicha island	312	Port facilities, storm signals	423
Talarambee point	121	Quarantine, tidal streams	422
Talpe station	118	Winds	424
Talum Phuk, Hin	485	Tavoy town	423
Talumpuk, Hin	485	Taylor hill	307
Tam Chok, Hlæm	482	Taylor patches	312
Tam Chok, Khao	482	Taylor shoal	268
Tamálu village	349	Tazaung tower	372
Tamarind island	412	Tazingyun	369
Tambalagam bay	145	Tazin-hmaw	296
Tamblegam, Lake	145	Teesta point	362
Tamblegam shoal	145	Tein chaung	428
Tamblegam spit	145	Telwatta point	108
Tamokkyi shoal	421	Temple island	321
Tan chaung	289	Temple point	222
Tanana rocks	122	Temple sound	22, 308
Tangagyochaung	288	Anchorage, caution	309
Tangalla bay	125	Temple Tree	222
Anchorage, dangers	125	Ten Degrees channel	346
Directions	125	Tenasserim division	14, 461
Tangalla point	123	Tenasserim island, anchorage	429
View	<i>facing</i> 126	Tenasserim river	437
Tangalla rock	125	Tenasserim river, Great	19, 437
Tangalla town	125	Tenasserim valley, Great	19
Tangalle point	125	Tenasserim river, Little	19, 437
Tangalle town	125	Tenasserim village	437
Tango island	455	Tenlaá bay	363
Tanjong Padah	472	Teressa island	351
Tanjore district	5	Anchorage	352
Tankharo island	276	Terrible, Middle	278
Tansheen, Hlæm	478	Terrible, North	278
Taping river	385, 396	Terrible, South	278
Tapir hill	416	Terribles, The	278
Tapping point	341	Tetchaung taung	419
Tara point	364	Tettu temple	194
Taralait bay	323	Tetulia river	250
Taraung taung	289	Thabeikkyin village	395
Tarmugli island	315	Thabut taung	408
Tartar rock	92	Thabye chaung	408
Tasai, Kō	483	Thailand	20
Tasou hill	307	Thalia shoal	301
Tat creek	265	Thames point	282

	Page		Page
Thamihlagyun	428	Toungoo river	399
Thanbo islet	438	Tounzoun point	399
Thane island	472	Tower hill	138
View	<i>facing</i> 480	Tower rock (Aladdin islands)	471
Thankes island	441	Tower rock (Batticaloa roads)	136
Thân-maw	417	Tower rock (Mergui archipelago)	442
Thapanzeik village	391	Town rock, buoy	405
Tharrawaw	384	Tradikeli hill	307
Thaton district	18	Trak islet, anchorage	360
Thaungyin river	18, 406	Tranativu	169
Thayaung village	398	Tranquebar, anchorage	179
Thayetmyo town	14, 386	Transit hill	130
Thêbu kyun (Little Quoin island)	297	View	<i>facing</i> 130
Thêbu kyun (Sandy island)	296	Tree island (Bentinck route)	448
Thedaw cement works	390	Tree island (Kô Chang)	473
Thetkaw, tidal semaphore	403	Tree island (Morrison bay)	453
Thetkethaung river	16, 365	Tree islet	320
Thetke chaung	370	Tree point	320
Thila islet	438	Tree rock	139
Thinbawgyin	370	Tree summit	282
Thin-bôn kyun	421	Tree-on-bluff	289
Thindaw	397	Treis islet	360
Thinganet chaung	290	Tria gala	104
Thitpok river	297	Trichinopoly district	5
Thityagyun island	427	Trichinopoly rock	6
Thomson hill	136	Trifels shoal	262
Thomson island	446	Trilby island	320
Thomson shoal	468	Trincomalee bay	140
Thonithorai	172	North-western side	141
Thonithorai temple	172	islands and dangers, buoy	142
Thornhill, Cape	307	South-eastern side	140
Thornhill island	308	islands and dangers	141
Thoroughfare creek	321	Trincomalee harbour	146
Thrai, Hlâm	485	Anchorage	152
Thuillier, Mount	22, 361	Climate, Health, Town	154
Thumb hill	296	Climatic table	71
Thung Ma Phrao, Khlông	483	Directions	153
Anchorage, directions	483	Eastern and northern sides	149
Thyne bank	295	beacons, buoyage, dangers	150
Tides	29	lights	149
Tiger point	249	Life-saving	155
Tigyaing village	395	Pilots, signal station	152
Tika, Pulau	466	Port facilities	155
Tillanchong island, anchorages	351	Quarantine	153
Times, Standard and Summer	37	anchorage	153
Ting-nga, Pulau	458	Tidal streams and currents	153
Tinyu chaung	408	Western side	146
Tirumalarâjanar river	178	beacons, buoyage, dangers	147
Tirumani	185	Trinkat island	354
Tirumullaivasâl town	6, 180	Trinkat Champlong bay, anchorage	363
Tirupporûr hill	185	Tripalur reef	185
Tiruvannamalai peak	6	Tripura hills	11
Tjik, Pak	480	Trotter island	445, 453
Toby rock	410	Tu-ante, Pulau	462
Todd, Mount	266	Tub-Moh, Khlông	483
Tokadin, Pulau	459	Tucker island	452
Tokwekwong	284	Tuft island	311
Tonbyaw chaung	437	Tuhan, Pulau	462
Tondaimanar	162	Tumble Down Dick rock	272
Tondi	5, 174	Tumbru	266
Anchorage, beacons	174	Tummalapenta	194
Light	174	Tundâha obelisk	220
Tongue island	468	Tunnel rock	459
Tonton, Pulau	472	Turrets islands	463
Topham, Cape	327	Turtle islands	321
Torilla island	471	Turtle point	222
Toungbadoung peak	416	Turtle reef	321
Toungnela	295	Turtle rock	319
Toungoo district	399	Tuson hill	307

	Page		Page
Tutthabo maw	462	Vellar river Tanjore district	164, 174
Twante	387	Vera island	456
Twante canal	17, 377, 387	Vera shoal	456
Twantewa	387	Veragalle point	121
Twenty-four Paganas district	12	Veralawinha point	126
Twin, East	319	Vestal, Cape	323
Twin, West	319	Vestal shoal	294
Twin island, North	299	Vettar river	177
Twin island, South	465	Vibart shoal (Hgnet Taung kyun)	297
Twin rock, North	465	Vibart shoal (Ritchies archipelago)	334
Twins, North	264	Victoria point	464, 472
Twins rocks	454	Anchorage	475
Two Fathoms rock	331	Victoria Point harbour	477
Two Hill island	460	Anchorage, settlement	477
Two Spade island	427	Violet island	448
Two Tree island	464	Viper island	341
		Virgel rocks	139
		Virumba rock	120
		Vizagapatam	9, 207
U Pe beacon	371	Anchorage	208
Uan gala	103	Beacons, buoyage	207
Uda point, landing	131	Climatic table	74
Udapitya point	105	Entrance channel, beacons	208
Udayagiri peak	10	Harbour, depths	208
Ugidaung ridge	267	Lights, signal station	207
Uheliya reef	103	Pilottage, prohibited anchorage	208
Ulandhe point	126	Port facilities, signals	209
Ullackalie lagoon	139	Spoil ground	207
Umbrella island	480	caution	208
Umbrella rock	448	Storm signals	207
Una islet	453	Town, winds	209
Unaeria rocks	124	Vizagapatam district	8
Unawátuna point	111, 117	Volcanoes, Mud	43
Ung-Chune island	298	Vrudha Gautami river	199
Unguan island	287	Depths	200
Union ledge	320		
Uppanār river	181	W.R.N.S. pier (Trincomalee)	151
Uppāda village	205	Wa kyun (Forrest strait)	462
Upper Long sand	237	Wa kyun (Ye river approach)	410
Light-buoy	238	Anchorage	412
Upper Irrawaddy	394	View	<i>facing</i> 416
Climate, fogs	396	Waal islet, landing	108
Uppu river	145	Wa-Ale kyun	460
Uppūteru river (Kistna district)	194	Wadinagala peak	135
Uppūteru river (Nellore district)	7, 193	Wæo, Kq	485
Urani point	128	Wahu rock	120
Utrecht bastion	112	Wakema	16
Uyu river	398	Walakanda	124
		Walapara	106
		Walawe ganga	2, 126
Vaigai river	5, 174	Wales rock, buoy	405
Vadarevu village, anchorage	196	Walkan island	272
Vākalapūdi lighthouse	202	Walker island	364
Valaichchenai river	138	Walkyeing taung	264
Valvedditturai	162	Waltair point	209
Vamsadhāra river	9, 211	Waltair suburb	209
Van island	459	Wa-maw	417
Vandeloos bay	138	Wara Galwala	114
Vandeloos point	138	Wara taung	408
Vanteyam Godāvāri river	199	Ward point	368
Varāha river	206	Warden island	442
Vasishta Godāvāri river	8, 199	Ward's channel	245
Vatturupallepanem village	194	Warning rock	445
Vegetable pier	150	Warreo clumps	199
Velanai	167	Warreo entrance	199
Vella Pertumuni reef	174	Warrington passage	459
Vellar river (South Arcot district)	6, 180	Warrington reef	457

	Page		Page
Warrington straits	459	Whale bay— <i>contd.</i>	
Wasp bay	355	Islands and dangers	457
Wasp point	352	Whale rock	445
Water pagoda, The	399	Whale rocks	421
Watering point	110, 117	Whaleback reef	453
Watta rock	125	Whaleback rock	463
Waulu gala	124	Whaler's rock	291
Wedge point	336	Whales reef	312
Wedge rock (Cleugh passage)	307	Wharf island	323
Wedge rock (Port Meadows)	336	Wheeler islands	224
Welcombe Hotel Cove pier	150	White bank	295
Weligama bay	119	White Cliff island	308
Anchorage, directions	120	White mountain	310, 325
Currents, town	121	White point	414
Islets and dangers, light	119	White rock (Ceylon)	139
Weligama point	119	White rock (Bentinck route)	444
Welihukka patch	114	White rock (Ramree harbour)	289
Welikada radio station	101	White rock (S. Matthew's island)	468
Radiobeacon	101	White rocks (Akyab)	270
Wellawatta station	101	Beacon	271
Weller island	444	White Sand hill	134
Welmadura island	104	White Top rock	143
Light	105	Whitehouse rock	336
Wemyss point	148	William island	425
Wendy island	449	Williams reef	445
Wera point	119	Williams shoal	294
Weragal kanda	102	Wilmot island	453
Weragala kanda	102	Wilson island (Mergui archipelago)	440
West bay (Katchall island)	358	Wilson island (Ritchies archipelago)	332
Anchorage, tidal streams	358	Wing rocks	459
West Bengal state	11	Winifred, Cape	351
West Canister islet	429	Winyaw river	18
West channel (Palk strait)	164	Wolf rock, buoy	368
West Coral bank	305	Wood harbour	279
West Harbour beacon (Rangoon river)	380	Anchorage, directions	279
West hill (Cheduba island)	285	Wood island	440
West hummock (Cheduba island)	286	Woodmason bay	319
West island (Cleugh passage)	307	Woodstock, Mount	408
West islet (Mergui archipelago)	442	Wreck point	334
West islet (Tenasserim island)	429	Wright island	454
West Passage island	446		
West point (Dhāmra river)	226	Yakada gala	104
West point (Outram island)	331	Yakala village	134
West point (Pussur river)	246	Yakgahagala point	105
West point (Ramree island)	282	Yakinage duwa	110, 118
West reef	297	Yakkala village	134
West rock	426	Yala river	131
West Sandy islet	296	Yala rock	119
West shoal	286	Yanam	5, 8
West Spur islet	441	Yanaon	8
West Twin islet	319	Yandoon town	385
Western channel (Hooghly river)	237	Yarada konda	206
Light-vessel	232	Yard cove	150
Western channel (Galle harbour)	112	Yaw chaung	385, 391
Western channel (Mātla river)	245	Ye district	413
Western channel (Rangoon river)	373	Ye kyun	286
Light-float	375	Ye river	410
Tidal streams	376	Approaches	409
Western Ghāts	196	anchorages, directions	412
Western Rocky island	469	islands and dangers	410
Western Sea reef	231, 237	tidal streams	412
Westminster Abbey	135	view	<i>facing</i> 416
Wet kyun	456	Beacons	413
Wetiepara rock	107	Directions	413
Wetkyein daung	264	Tides, tidal streams	413
Whale bay	457		
Anchorage	456		
Approaches	456		

	Page		Page
Ye river— <i>contd.</i>		Ywe river	365
Town	414	Ywebathaung channel	388
Yele kyun	402		
Yemyok	438	Zahora rock	445
Yenangyat village	391	Zalat taung	291
Yenangyaung town	14, 389	Zalun	388
Yengan chaung	457	Zami river	18
Yengē kyun	438, 444	Zibuthang reach	413
Yetagun taung	416	Zibyuthaung point	413
Yin chaung	390	Zibyuthaung reach	413
Yoma mountains	15	Zikha taung	283
Yoonzaleen river	406	Zingyaik range	398
York island	151	Zotzit flat	426
York shoal, buoyage	151	Zotzit hill	424
Yot-pa	298	Zotzit point	424
Yu river	398	Zulfiquar channel	247
Yunzalin river	406	Anchorages, beacons, light	248
Yuwa village	398	Buoyage	247
Ywathit taung	284		

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SUPPLEMENT No. 1—1955

RELATING TO THE

BAY OF BENGAL PILOT

EIGHTH EDITION, 1953

CORRECTED TO 24th MAY, 1955

**Whenever reference is made to the Pilot,
this Supplement must be consulted**

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LONDON

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Agents for the Sale of Admiralty Charts**

1955

Gratis to purchasers of Bay of Bengal Pilot

ADVERTISEMENT TO SUPPLEMENT No. 1

This Supplement has been compiled by Commander H. V. Silk, R.N., from information received in the Hydrographic Department of the Admiralty, relating to the Bay of Bengal Pilot, Eighth Edition, since its publication, in 1953.

The Supplement should be retained intact for reference ; its existence is to be noted on the tabular form inside the cover of the Pilot.

Whenever reference is made to the Pilot, this Supplement must be consulted.

All information affecting the Bay of Bengal Pilot, 1953, contained in Notices to Mariners, up to and including No. 1291 of 1955, has been embodied in this Supplement ; for temporary and preliminary Notices to Mariners affecting this edition, the list of temporary and preliminary Notices to Mariners in force published monthly in the Weekly Complete Edition of the Admiralty Notices to Mariners, should be consulted.

A. DAY,
Vice-Admiral,
Hydrographer of the Navy.

Hydrographic Department,
Admiralty, London,
24th May, 1955.

1562960

relating to the

BAY OF BENGAL PILOT

EIGHTH EDITION, 1953

(Corrected to 24th May, 1955)

Front fly-leaf.—Below "No. 8" insert:—

No. 8A WARNING SIGNALS TO DENOTE THE PRESENCE OF A SUNKEN SUBMARINE.

Page vii.—View No. 7: *For* "Friar's Hood from east-north-eastward" *read* "Friar's Hood from east-south-eastward"

Page xiv.—Line 20: *Delete and substitute:*—

(ii) Prior to 1954, when a chart was corrected from information which was "

Line 22: *For* "is" *read* "was"

Lines 24, 33 and 34: *For* "are" *read* "were"

Lines 30-31: *Delete and substitute:*—

These indicated that the chart plate received minor corrections on the 20th of May or the 25th of June, respectively, which would appear on later printings.

Line 35: *For* "may be" *read* "might have been"

Line 38: *For* "does" *read* "did"

After line 38 insert:—

(iii) Since 1954, in order that more attention may be given to New Editions, Large Corrections and corrections by Notices to Mariners, and for other reasons, the making of minor corrections to chart plates as in (ii) has been discontinued. Information of no importance to safe and convenient navigation is instead recorded for inclusion in the next New Edition or Large Correction; or for promulgation in a later Notice to Mariners should a change of circumstance alter the importance of the information.

In consequence the small correction date enclosed in a rectangle does not appear later than 1953 on navigational charts. The date within brackets may still appear and is then an indication that magnetic compasses have been corrected for a change in variation.

Page xvii.—Lines 23-25: *Delete and substitute:*—

"per month; however, if there are insufficient corrections to justify the publication of a new edition of any volume, this will be notified by Notice to Mariners."

Line 28: *For* "six" *read* "eight"

Page xvii continued.

Line 31: *Delete and substitute:—*

"Section III of the Weekly Complete Edition of Admiralty Notices to Mariners announcing the publication of the new volume."

Lines 36-40: *Delete and substitute:—*

"during the week affected; this Section also includes other amendments, particularly those of a temporary nature which have not yet, or will not, necessitate the issue of a Notice to Mariners.

All temporary information is now incorporated in Admiralty Lists of Lights. The word "Temporary" is printed against such information in heavy type in Column 10.

Corrections to the Light Lists may be extracted "

Line 48: *For " in three volumes " read " as follows:— "*

Line 51: *After " radio " insert " distress signals and details of air-sea search and rescue organization "*

Lines 53-55: *Delete " , radiobeacons " to " signals) " and substitute " and radiobeacons, including air radiobeacons useful to ships; also stations giving QTG service and calibration stations "*

Page xviii.—Line 2: *Delete and substitute:—*

" relevant codes.

Volume IV.—Meteorological observation stations.

Volume V.—Comprises particulars of radio time signals, uniform time system, navigational warnings and position fixing systems (Decca, Loran, Consul, etc.)."

Page xx.—Lines 54-55: *For " astro-nomical " read " geo-graphical "*

Page xxi.—Lines 2 and 11: *For " astronomical " read " geographical "*

Page xxvi.—*For " Volume II " read " Volumes II and V "*

Page xxvii.—Line 51: *For " July " read " January "*

Page xl.—Line 30: *For " Volume III " read " Volumes III and IV."*

Index to Admiralty published charts, S.D. 21, facing page 1.—

Insert new chart No. 732 between:—

Lat. 21° 22' N., and Lat. 22° 59' N. and

Long. 89° 20' E. and Long. 89° 44' E.

Lat. 7° 10' N., Long. 94° 30' E.: *Delete " Lafûl ⚓ 840* "*

Lat. 7° 50' N., Long. 94° 30' E.: *Delete " Hoinipoh B. 840* "*

Lat. 9° 15' N., Long. 93° 00' E.: *For " Mus " read " Malacca "*

Page 36.—*After line 12 insert:—*

Thailand.—The system of buoyage in Thai waters is as follows:—

The term *starboard hand* denotes that side which would be on the right hand of the mariner when approaching or entering a harbour, river or estuary from seaward.

The term *port hand* denotes the left hand of the mariner in the same circumstances.

Page 36 continued.

Starboard hand buoys are pillar buoys painted green. If numbered, the numbers are odd and commence from seaward. If lit, they generally exhibit *green* or *white flashing* or *occulting* lights.

Port hand buoys are pillar buoys painted red. If numbered, the numbers are even and commence from seaward. If lit, they generally exhibit *red* or *white flashing* or *occulting* lights.

Buoys marking wrecks in the vicinity of channels are pillar buoys painted black. They exhibit *red* or *green flashing* lights according to whether they lie on the port or starboard side of the channel, respectively.

Buoys marking shoals or rocks in the vicinity of channels are pillar buoys painted white with black bands. They may exhibit *red* or *green flashing* lights according to whether they lie on the port or starboard side of the channel, respectively.

Buoys marking isolated dangers are painted white with black bands. They may be spherical in shape, and surmounted by a white daymark consisting of a cone above a cylinder, or they may be truncated conical in shape and surmounted by a sphere.

Buoys marking isolated wrecks are spherical in shape and painted black, and are surmounted by a white daymark consisting of a cone above a cylinder. If lit, they may exhibit *white*, *red* or *green* lights.

See sketches facing this page.

Page 37.—Line 36: *For " Vol. II " read " Vol. V "*

Line 41: *For " altitude " read " elevation "*

Page 38.—Line 30: *After " Calcutta," insert " Khulna,"*

Line 33: *Delete.*

Page 40.—Lines 30-31: *Delete " 28 " to " 1926 " and substitute " 17 of the International Sanitary Regulations "*

Page 92.—Line 36: *After " which " insert " , with a depth of 5½ fathoms (10^m5) over it,"*

Line 43: *For " 2¾ cables south-south-" read " 3 cables west-north-"*

Page 93.—Line 44: *For " 1952 " read " 1954 "*

Line 46: *Add:—The work, when completed, will be known as Queen Elizabeth quay.*

Page 94.—Line 20: *For " refuge " read " refuse "*

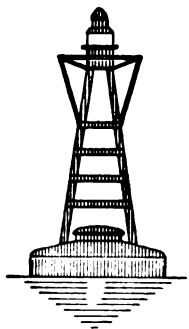
Page 96.—*After line 15 insert:—*

In 1953, works were in progress on the construction of Delft pier, in the vicinity of the passenger jetty.

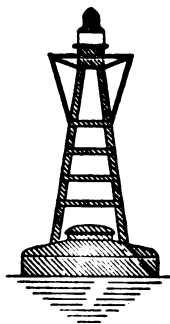
Page 102.—*After line 8 insert:—*

A light, for the use of aircraft is exhibited, at an elevation of 73 feet (22^m3), about 2 miles south-south-eastward of the above-mentioned leading lights.

THAI BUOYAGE SYSTEM

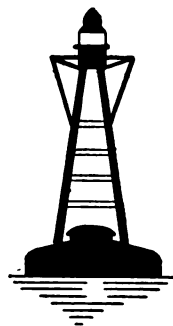


Port-hand

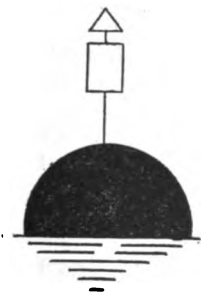


Starboard-hand

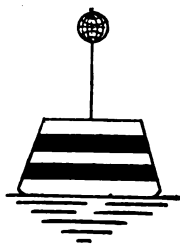
— CHANNEL BUOYS —



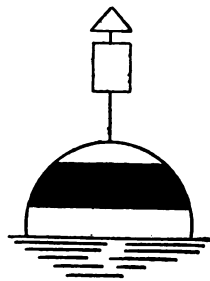
WRECK BUOY
(Channel)



WRECK BUOY
(isolated)



ISOLATED DANGER
BUOYS



For Colour Key see Diagrams at foot of Caution facing Page ii.

Page 146.—Line 38: *For "Light-buoy.—" read "Buoy.—"*
 Lines 40-41: *Delete "light-buoy" to "seconds" and substitute "buoy, painted red,"*

Page 147.—Line 18: *Add:—*There is a 30-foot (9^m1) wide gap in the causeway about one cable westward of the western Great Sober island; there is a depth of 10 feet (3^m0) in the channel through the gap, each side of which is marked by a concrete beacon.

Line 40: *For "2" read "1½"*

Lines 49-50: *Delete "can" to "and" and substitute "black mooring buoy"*

Page 148.—Lines 44-45: *Delete "is" to "crane" and substitute "are two cranes"*

Line 46: *After "pier" insert "; there are three cranes, of 5, 8 and 10 tons capacity, on this pier"*

Page 149.—Lines 3-4: *For "two 2-ton cranes" read "a 5-ton and a 10-ton crane"*

Line 13: *For "3-ton" read "small hand"*

Line 45: *Add:—*A light is exhibited from the head of a radio mast, 257 feet (78^m3) high, about three-quarters of a cable eastward of this light.

Page 150.—*After line 19 insert:—*

Peppertop pier, from the head of which a light is exhibited, extends about one cable from a position about 3 cables north-eastward of the root of Admiralty House pier.

Page 151.—Line 38: *Add:—*These rocks are marked on their north-eastern side by a small spherical buoy, painted in black and white horizontal bands, and on their south-western side by a small can buoy, painted in red and white chequers; a small white conical buoy and a small spherical buoy, painted in black and white horizontal bands, mark the edge of the shore bank about a quarter of a cable and half a cable, respectively, south-westward of the two rocks; these buoys are for the use of boats.

Page 152.—Lines 40-41: *Delete "black" to "seconds" and substitute "can buoy, painted in black and white chequers"*

Page 155.—Line 19: *For "Sagaing" read "Saigang"*

Line 37: *For "144" read "141"*

Page 163.—Lines 32-35: *Delete "A" to "shoal."*

Page 221.—Line 27: *For "Makānadi point.—Coast.—" read "Mahānadi point.—Coast.—Outlying shoal.—"*

Line 42: *Delete and substitute:—*

A shoal, with a depth of 6 fathoms (11^m0) over it, was reported, in 1954, about 23 miles south-eastward of the entrance to Jatādharmohan river and 26 miles eastward of Devi point.

Chart 814.

Page 222.—Lines 7 and 19: *For* "755" *read* "814"

Line 23: *For* "4½" *read* "6½"

Lines 24-35: *Delete and substitute:*—
"ward."

Line 49: *Delete* " (South Broni) "

Line 54: *Delete* " (Broni Mohan creek) "

Page 223.—Lines 4-23: *Delete and substitute:*—

Chart 814.

Lines 35-54: *Delete.*

Page 224.—Line 1: *Delete and substitute:*—

Chart 814.

Line 4: *Delete.*

Lines 7 and 8: *Delete* " (Maipara) "

Page 232.—Line 8: *Delete* " the lower half of "

Line 17: *For* "south-eastward" *read* "east-south-eastward"

Line 34: *For* "5" *read* "7"

Page 238.—Line 6: *For* "2" *read* "3"

Line 8: *For* "30" *read* "7"

Line 9: *For* "1½ miles westward" *read* "2½ miles north-westward"

Line 12: *For* "19½" *read* "20"

Line 13: *For* "2½" *read* "3"

Line 15: *After* "with" *insert* " the lower half of "

Line 21: *For* "buoys" *read* "light-buoys"

Line 22: *For* "buoy" *read* "light-buoy, exhibiting a red group flashing light showing two flashes,"

Lines 23: *For* "5" *read* "4½"

Line 24: *For* "buoy" *read* "light-buoy, exhibiting a white group flashing light showing two flashes,"

Page 239.—Line 7: *For* "T.R." *read* "L.R."

Line 10: *For* "stripes" *read* "bands"

Page 246.—Line 47: *Delete and substitute:*—

Chart 732, Compartment (A).

Lines 49-50: *Delete* " (Lat." to "7" and *substitute* " (Lat. 21° 43' N., Long. 89° 23' E.), about 2½ miles eastward of Putney island, and Jefford point, about 8"

Page 247.—Line 1: *Delete and substitute:*—

Chart 732, Compartments (A) and (B).

Line 9: *For* "5" *read* "6½"

Line 11: *For* "2½ miles" *read* "a mile"

Line 13: *For* "5" *read* "5½"

Lines 24-25: *Delete* "in" to "6½" and *substitute* "about 20 miles south-eastward of West point and about 3"

Line 26: *After* "Ground" *insert* " , as defined by the 100-fathom (182^m) line "

Page 247 continued.

Lines 31-34: *Delete* "A" to "7½" and *substitute* "A red can buoy marks the north-eastern side of a 3-fathom (5^m5) bank, detached from the bar proper, about 7½"

Lines 37-38: *Delete.*

Line 39: *After* "a" *insert* "conical"

Line 40: *Delete* "flashing" to "seven" and *substitute* "group flashing light showing two flashes every ten"

Line 41: *For* "12½" *read* "10½"

Line 42: *After* "a" *insert* "can"

Line 43: *Delete* "flashing" to "7½" and *substitute* "group flashing light showing three flashes every ten seconds, is moored about 6½"

Line 45: *After* "a" *insert* "conical"

Line 46: *For* "two" *read* "four"

Line 47: *For* "4½ miles east-south-" *read* "5½ miles"

Lines 49-51: *Delete.*

Line 54: *For* "truncated cone" *read* "can"

Page 248.—Line 2: *For* "3½" *read* "3"

Line 4: *For* "Light" *read* "Lights"

Line 5: *For* "64 feet (19^m5)" *read* "60 feet (18^m3)"

After line 6 *insert*:—

A light is exhibited, at an elevation of 60 feet (18^m3), from a white iron framework tower, 60 feet (18^m3) in height, on Jefford point.

Lines 9-10: *Delete and substitute*:—

"is also a beacon, with an elevation of 60 feet (18^m3), on Sipsa point."

Line 25: *For* "7 miles north-westward" *read* "2½ miles north-north-westward"

Line 47: *Delete* "2 miles" to "light-buoy" and *substitute* "4 miles north-westward of Pussur light-vessel"

Line 50: *For* "the Outer Bar buoy" *read* "a position about 3 miles north-north-westward of Pussur light-vessel"

Page 249.—Line 26: *Delete* "Nos." to "5" and *substitute* "the"

Line 34: *For* "20" *read* "12"

After line 44 *insert*:—

There is a radio station at Khulna; *see* page 38.

Page 253.—Line 51: *Add*:—Vessels using this anchorage for more than a few tides should note the way the vessel swings at the change of the tidal stream as she is liable to swing in one direction only; the vessel should therefore sight her anchor at regular intervals to avoid its fouling.

Page 254.—Line 32: *For* "1951-52 was greatly" *read* "1954 was being"

Page 255.—Lines 5-7: *Delete and substitute*:—

Depths.—The normal depth on the outer bar is 15 feet (4^m6) and that on the inner bar and Gupta Crossing (Lat. 22° 16' N., Long. 91° 50' E.) about 12 feet (3^m7).

Page 256.—Line 2: *After* "pilot." *insert*:—Vessels requiring a pilot should advise the Port Authorities 24 hours in advance.

Page 256 continued.

Line 11: *Delete and substitute:—*

" 24 feet (7^m3) can enter or leave the port. The Port Authorities issue a maximum safe draught table, obtainable on request."

Page 257.—Line 1: *For "Kanraphuli" read "Karnaphuli"*

Line 30: *After "November," insert "1920, off the railway jetties,"*

Line 32: *Add:—*In June 1932 no flood stream was experienced for 48 hours during a freshet.

Line 42: *For "3" read "2"*

Page 258.—Lines 3-4: *Delete "3,120" to "(7^m9)" and substitute "4,000 feet (1,219^m2) long, with depths of from 16 to 20 feet (4^m9 to 6^m1) alongside"*

Line 5: *For "seven" read "eight"*

Line 6: *For "1½" read "1¾"*

Lines 7-11: *Delete and substitute:—*

"light jetties and two pontoon jetties suitable only for light cargo, but they can accommodate vessels of any draught. All cargo is loaded and unloaded at the jetties; in the dry season deeply laden vessels lighten at the outer anchorage before going alongside the jetties to discharge."

Lines 19-20: *Delete "chief" to "European" and substitute "principal town in the district. The residential"*

Lines 23-28: *Delete and substitute:—*

In 1953 the estimated population was 250,000.

The district is healthy, except towards the close of the rainy season when fever persists.

Line 45: *After "jetties" insert ", or by barge"*

Lines 46-47: *Delete "is" to "(143^m3)" and substitute "are three head and stern mooring buoy berths for vessels up to 525 feet (160^m0)"*

Line 52: *For "220" read "1,000"*

Line 53: *Delete "Repairs" to "undertaken" and substitute "Minor repairs to vessels can be effected afloat"*

Page 259.—Lines 2-3: *Delete.*

Line 4: *For "200 beds" read "accommodation for 100 patients"*

Lines 5-6: *Delete "Indian" to "Rangoon" and substitute "Karachi, Colombo and Cox's Bazar"*

Line 7: *After "Dacca" insert ", Rangoon"*

Lines 10-13: *Delete and substitute:—*

The principal exports are jute, tea, skins and hides, chillies and betel nuts; the chief imports are food grains, coal, salt, machinery and constructional materials.

In 1952-53 a total of 315 steam vessels, of 1,044,904 tons, entered the port. The total imports were 1,703,107 tons and total exports 1,213,004 tons.

Line 14: *After "station" insert "and a radio D.F. station"*

After line 14 insert:—

Storm signals.—Storm signals are shown at Juldia signal station; the extended system is used, *see* page 30. Copies of the storm warnings are sent on board each ship alongside the jetties.

Page 262.—Lines 3-4: *Delete ", exhibiting" to "seconds"*

Page 271.—Line 5: *Delete* "a" to "(4^m9)" and *substitute* "depths of 24 feet (7^m4), or less, and a least depth of 18 feet (5^m5)"

Line 6: *For* "three-quarters of a mile" *read* "13 cables"

Line 7: *For* "1½ miles" *read* "11 cables"

After line 7 insert:—

Close north-westward of the central part of Saunders shoal there are depths of from 22 to 24 feet (6^m7 to 7^m3) over an area about 4 cables long and 2 cables wide.

Lines 9-12: *Delete* "about" to "shoal" and *substitute* "near the south-western end of Saunders shoal about 1½ miles eastward of Fakir point"

Line 21: *Delete* and *substitute*:—

"flashing light every two seconds is moored about 3 cables northward"

Line 24: *After* "**Buoys.**" *insert* "**Beacons.**"

Lines 35-36: *Delete* "24" to "(7^m3)" and *substitute* "22 to 30 feet (6^m7)"

Line 37: *Delete* and *substitute*:—

"Two can buoys, Nos. 15 and 25, are moored about 2½ and 3½ miles, respectively,"

Line 39: *Add*:—Can buoys, Nos. 1P and 2P, mark the western side of the fairway about 6 cables and 1½ miles, respectively, north-north-eastward of the main wharf.

Line 40: *For* "entrances" *read* "entrance"

Lines 42-43: *Delete* "and" to "buoys" and *substitute* "is marked by a buoy"

Line 45: *After* "chaung" *insert* ", about 2 miles north-north-eastward of Satyogya chaung,"

Line 46: *Delete* "up" to "and"

Lines 50-54: *Delete* and *substitute*:—

Between Fakir point and a position about 4 miles northward there are numerous pairs of beacons, and some single ones, on the western side of the harbour; their positions can best be seen on the chart.

Page 272.—Lines 2-4: *Delete*.

Line 5: *For* "Kywegu" *read* "**Eastern branch of Kaladan river.—Danger.—Kywegu**"

Line 48: *Delete* "in" to "(6^m4)"

Lines 50-51: *Delete* "between" to "(7^m3)" and *substitute* "north-westward of Saunders Shoal light-buoy in depths of from 22 to 30 feet (6^m7 to 9^m1)"

Page 273.—Lines 47-50: *Delete* "In" to "(6^m4)."

Page 278.—Line 10: *Delete* "**Buoys.**"

Lines 38-39: *Delete* "A" to "bank."

Page 279.—Lines 8-9: *Delete* "A" to "shoal."

Line 47: *For* "**Buoyage.**" *read* "**Light-buoy.**"

Page 280.—Lines 9-10 and 36-37: *Delete* "A" to "shoal."

Page 292.—Line 51: *For* "Considerably shoaler" *read* "Shoaler"

Line 52: *For* "1936" *read* "1952"

Page 299.—After line 46 insert:—

A shoal, with a depth of 8 fathoms (14^m6) over it, the position of which is approximate, was reported, in 1953, about 2½ miles north-westward of the above-mentioned shoal.

Page 310.—After line 19 insert:—

A 2-fathom (3^m7) patch lies about 1½ miles south-eastward of the eastern extremity of North Reef island.

Page 328.—After line 42 insert:—

The above-mentioned buoys cannot be depended on.

Page 339.—Line 23: For "18-foot (5^m5)" read "12-foot (3^m7)"

Line 24: For "2½" read "2¾"

Line 25: After "point." insert:—A 17-foot (5^m2) rocky patch lies very close to the leading line through the southern entrance channel about 3¾ cables south-eastward of Atalanta Point beacon.

Line 31: After "island" insert " , but close westward of the 17-foot (5^m2) patch just mentioned "

Page 341.—Lines 10-13: Delete "Two" to "flat." and substitute:—

Three white conical buoys are moored about 4½ cables east-north-eastward and 4½ cables south-eastward and south-south-eastward of Shore point and mark the north-eastern, south-eastern and southern sides, respectively, of Ranger flat; these buoys often appear to be red due to rust.

A 12-foot (3^m7) rocky patch lies about 4 cables southward of shore point.

Line 15: After "flat" insert " , but practically over the 12-foot (3^m7) patch just mentioned."

Line 24: For "half a mile" read "6½ cables"

Line 25: Delete "42" to "14^m6)" and substitute "37 to 41 feet (11^m3 to 12^m5)"

Line 26: For "068°" read "060°"

Page 342.—Line 8: After "island" insert " , but very close to the 17-foot (5^m2) rocky patch about 3¾ cables south-eastward of Atalanta Point beacon."

Page 346.—After line 53 insert:—

Outlying bank.—An outlying bank, with a depth of 54 fathoms (98^m8) over it, which has not been examined, was reported, in 1954, about 59 miles south-south-eastward of Narcondam island and 54 miles east-north-eastward of Barren island.

Page 349.—Line 15: Delete.

Line 16: After "Anchorages." insert "Beacons."

Line 26: Delete and substitute:—

Chart 840, with plan of Malacca anchorage.

Line 34: Add:—A beacon, surmounted by a white triangle, stands about one cable southward of Tamálu and another, surmounted by a white cross, stands in Perka village.

Line 35: After "Anchorage." insert "Beacons."

Line 36: For "half" read "a quarter of"

Page 349 continued.

Lines 39-42: *Delete* " but " to " head." and *substitute* " and it was reported, in 1953, that the jetty was unsuitable for use as a boat landing due to the remains of a wreck along the southern side and rocks along the northern side; wreckage also extends about 50 feet (15^m2) southward from the head of the jetty. Boats should, therefore, be beached on the sand at high water.

After line 47 insert:—

There are two flagstaffs in the village.

Page 350.—Line 1: *Delete* and *substitute:—*

Chart 840, plan of Malacca anchorage.

After line 3 insert:—

A beacon, surmounted by a white cross, stands about 2 cables south-south-eastward of the root of the jetty.

A beacon, surmounted by a white triangle, stands on the coast about 7 cables south-south-eastward of the root of the jetty.

After line 14 insert:—

Chart 840.

Page 359.—Line 11: *Delete.*

Page 363.—Line 29: *Delete* and *substitute:—*

Chart 840.

Line 46: *Delete.*

Page 366.—Lines 6-7: *Delete* and *substitute:—*

" A can light-buoy, painted red and exhibiting a *white flashing* light showing a *short flash every two seconds*, is moored about "

Line 10: *For* " quarters " *read* " vertical stripes "

Page 368.—Lines 42-44: *Delete* " A " to " 2 " and *substitute* " A black can buoy is moored about 2½ "

Page 371.—Line 8: *For* " 40 " *read* " 34 "

Line 46: *After* " **Buoys.**—" *insert:—*A light is exhibited, at an elevation of 40 feet (12^m2), from a light-vessel, painted red with 'BARAGUA' in white letters upon her sides, having a light-tower and one mast with two black balls at the masthead, moored about 23½ miles south-south-westward of Baragua point; the light-vessel is fitted with a radar reflector on the highest point of the light-tower and a riding light is exhibited. A red conical watch buoy is moored about 2½ cables northward of the light-vessel.

Line 50: *For* " 45 feet (13^m7) " *read* " 40 feet (12^m2) "

Line 51: *For* " Krishna " *read* " KRISHNA "

Line 52: *For* " red " *read* " black "

Page 372.—Line 3: *After* " shoal." *insert:—*A fog signal is sounded from the light-vessel and she is fitted with a radar reflector on the highest point of the light-tower.

Line 4: *Delete* " black " to " 3 " and *substitute* " red conical watch buoy is moored about 2½ "

Lines 19-20: *Delete.*

Page 376.—Line 3: *For* " 1½ " *read* " 1½ "

Page 377.—Line 12: *After* "suburb of" *insert* "Dalla, or"

Page 378.—Line 17: *Delete* "The" to "by"

Line 19: *Delete* "four" to "-westward" and *substitute* "five seconds, is moored about 3½ cables north-eastward"

Line 20: *After* "point;" *insert* "Central Middle Bank light-buoy, painted black and exhibiting a *red flashing* light *every four seconds*, is moored about 11 cables north-westward of Elephant point;"

Line 21: *After* "seconds" *insert* "is"

Line 49: *For* "(Kyautan creek)" *read* ", or Kyautan creek,"

Page 379.—Line 37: *After* "point." *insert*:—Middle Chokey can light-buoy, painted black and exhibiting a *white flashing* light *every second*, is moored about 9 cables north-westward of North D'Silva point.

After line 49 *insert*:—

A survey beacon, surmounted by a basket and known as Bailey's beacon, stands near the western bank of the river about 9 cables north-westward of D'Silva front leading light.

Page 382.—Lines 5-12: *Delete and substitute*:—

Between positions about 1¼ and 3¼ miles westward of Monkey point there are numerous obstructions and wrecks in the river, the positions of which can best be seen on the chart.

Page 383.—Line 26: *For* "(Dalla)" *read* ", or Dalla,"

Page 387.—Line 20: *Delete*.

Page 388.—Line 1: *Delete and substitute*:—

Charts 830 and 70.

Line 14: *Delete*.

Page 389.—Line 1: *Delete and substitute*:—

Chart 70.

Line 42: *Delete*.

Page 390.—Line 1: *Delete and substitute*:—

Chart 70.

Page 391.—Line 1: *Delete and substitute*:—

Chart 70.

Page 392.—Line 1: *Delete and substitute*:—

Chart 70.

Page 393.—Line 1: *Delete and substitute*:—

Chart 70.

Line 33: *Delete*.

Page 417.—Line 7: *Delete* "(Oyster island)"

Line 11: *Delete* "(Lakhatoung)"

Line 17: *Delete* "(Nyaw-byin point)"

Page 418.—Line 29: *Delete* " (Kynakpyu) "

Page 419.—Line 37: *For* " westward " *read* " northward "

Page 424.—Line 27: *Delete* " (South hill) "

Page 425.—Line 16: *For* " Iron island (Thamihlagyun) " *read* " Thamihlagyun, or Iron island, "

Page 426.—Line 22: *Delete* " (North rocks) "

Line 27: *Delete* " (Grey rocks) "

Line 54: *For* " $3\frac{1}{4}$ fathoms (5^m9) " *read* " $2\frac{3}{4}$ fathoms (5^m0) "

Page 427.—Line 2: *For* " Mandrell " *read* " Maundrell "

Line 8: *After* " reef, " *insert* " on which stands a beacon, "

Line 19: *For* " Long " *read* " Kadwe or Long "

Page 428.—Line 3: *For* " Iron island (Thamihlagyun) " *read* " Thamihlagyun or Iron island "

Line 47: *Delete* " (Kabosa) "

Page 429.—Line 14: *For* " 1,020 " *read* " 1,620 "

Line 32: *Delete* " (Saurin) "

Page 431.—Line 31: *For* " 480 " *read* " 460 "

Line 32: *For* " 146^m3 " *read* " 140^m2 "

Page 440.—Line 24: *After* " dries " *insert* " ; a $3\frac{3}{4}$ -fathom (6^m9) patch lies about 4 cables northward of the northern islet and a 2-fathom (3^m7) patch lies about 3 cables south-eastward of the southern islet "

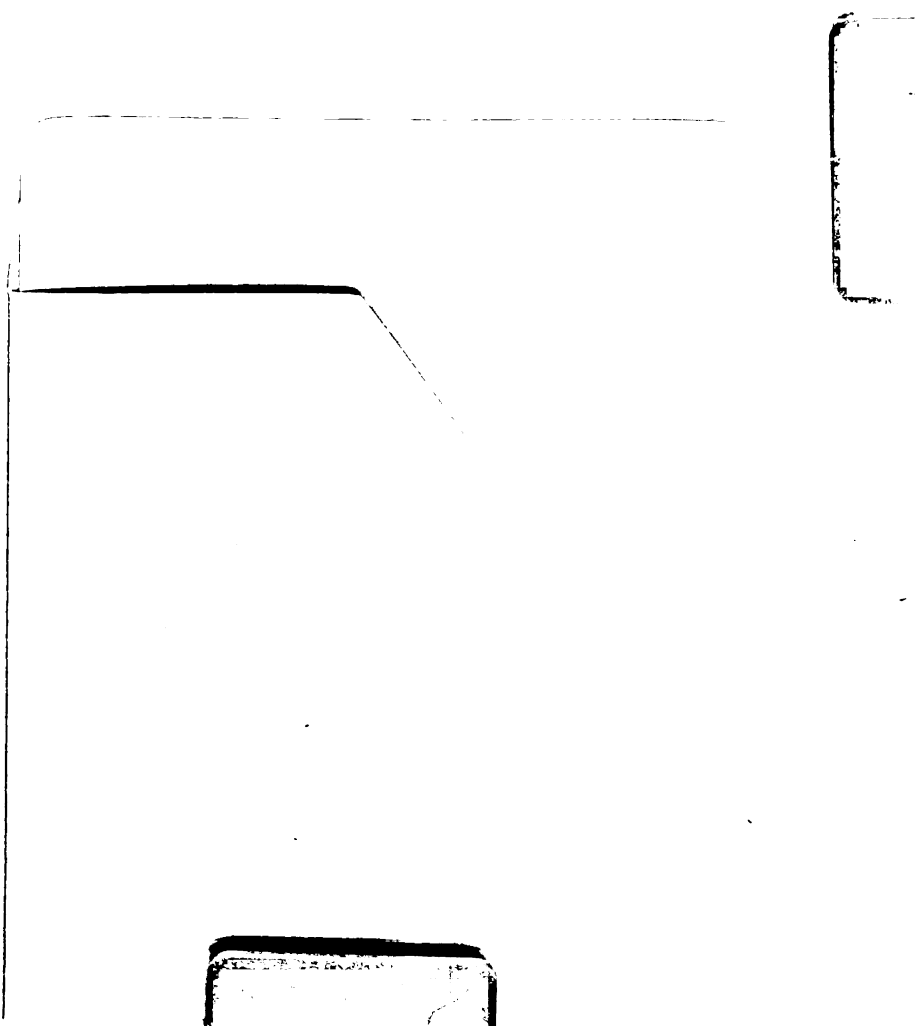
NEW AND ALTERED NAMES

The following list gives new names and alterations in old names which will be adopted in all Hydrographic publications affected as opportunity occurs:—

New name	Page of Pilot	Obsolete name
Bailey's beacon . . .	379	—
Maundrell reef . . .	427	Mandrell reef
Pepperpot pier . . .	150	—
Saigang pontoon . . .	155	Sagaing pontoon

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